Compressed Air Magazine

JUNE 1956

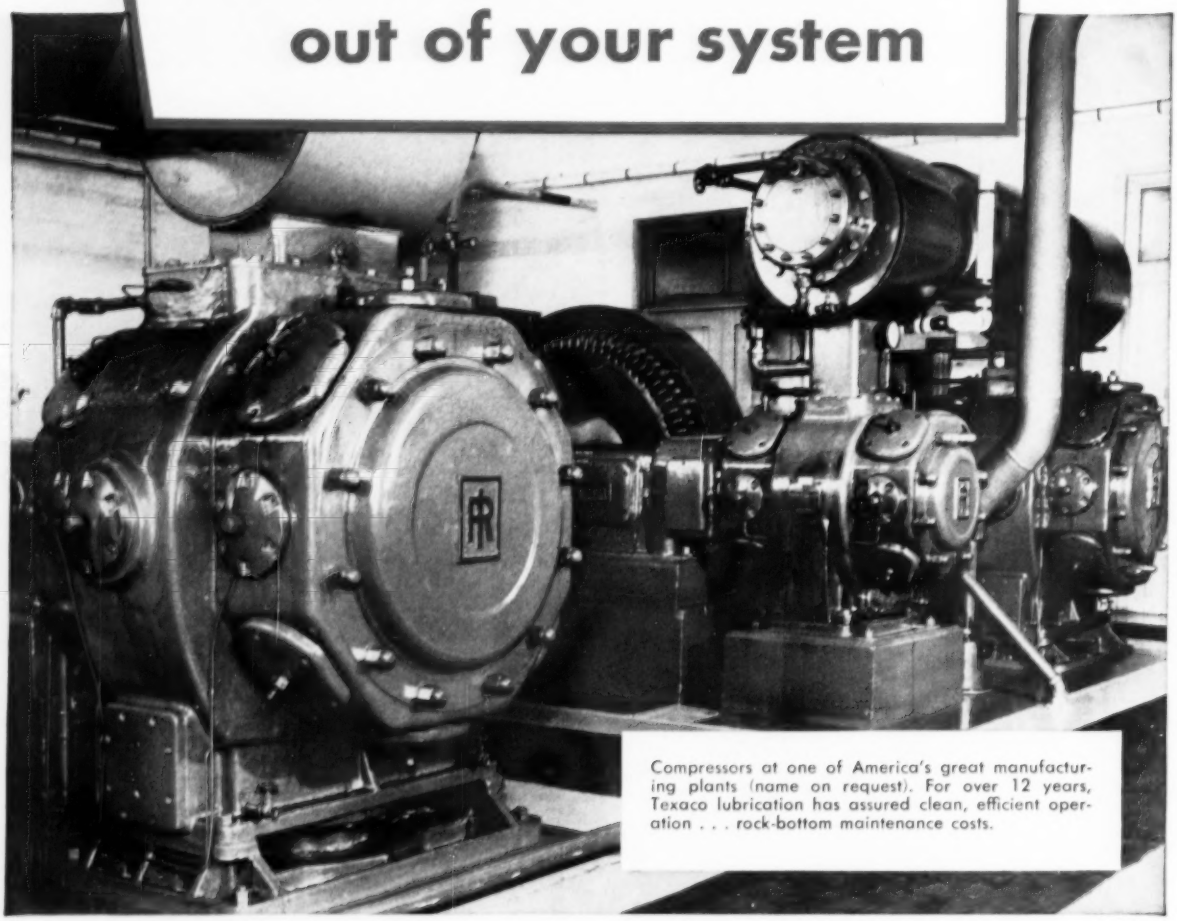
BIG PUSH FOR KING-SIZE PIPE

Workmen guides section of refinery drainage line into open trench

(SEE INDEX PAGE AND PAGE 160)

VOLUME 61 • NUMBER 6 NEW YORK • LONDON

Keep deposits and rust out of your system



Compressors at one of America's great manufacturing plants (name on request). For over 12 years, Texaco lubrication has assured clean, efficient operation . . . rock-bottom maintenance costs.

WITH *TEXACO REGAL OIL R&O* in your air compressor systems, you get highest operating efficiency, unhampered by deposits or rust. *Texaco Regal Oil R&O* is especially refined to keep compressors clean, to assure smooth-working valves and free piston rings. Naturally, you'll get more dependable performance at considerably reduced maintenance costs.

TEXACO REGAL OIL R&O is made from choice base stocks, then further improved by extra processing and effective additives. This accounts for its high oxidation resistance and ability to prevent harmful deposits.

There is a complete line of *Texaco Regal Oils R&O*—one of which will exactly meet the requirements of your air compressors and operating conditions.

Let a Texaco Lubrication Engineer help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

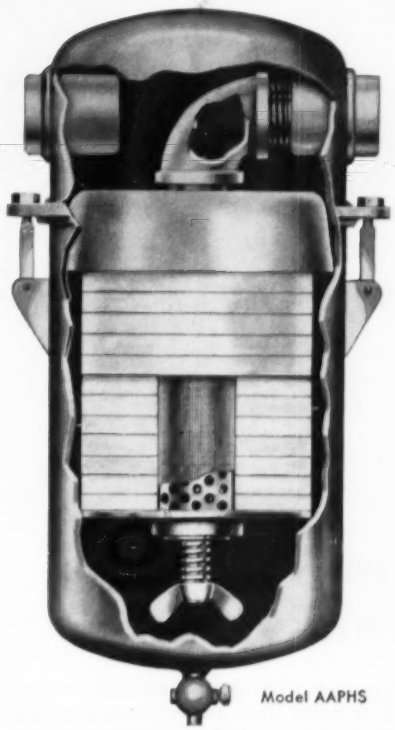
FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE on television . . . Saturday nights, NBC.

Circle 1A on reply card

does the WEATHER get in your AIR LINES?

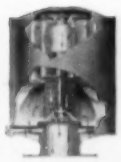
you need STAYNEW ABSORPTION FILTERS



Model AAPHS

At this time of year—when the humidity is high—your compressed air lines carry lots of water . . . water that can rust and clog your equipment, ruin your work, or shut down your boilers.

That's why you need Staynew Absorption Filters in your lines. They remove every last trace of oil and moisture. In thousands of installations throughout the country Staynew Absorption Filters are protecting equipment and preventing process interruption . . . in most cases they are positively essential.

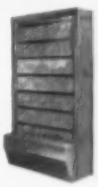


INTAKE FILTERS

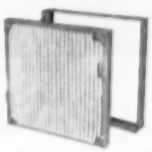
LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR



AUTOMATIC AIR FILTERS



PANEL FILTERS

SPECIAL FILTERS

DOLLINGER PROTECTO-MOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Why not get all the facts, write for Bulletin 200 today. Dollinger Corporation, Dept. 7, Centre Park, Rochester 3, N.Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Circle 2A on reply card

Bethlehem Hollow Drill Steel shown biting into limestone at Reading, Pa., on a recent pipeline project for City of Reading, Bureau of Water.

8,355 cu yd of Limestone Moved for Pipeline in Eastern Pennsylvania

One of the tasks confronting Gilbert Associates, Reading, Pa., prior to the installation of a steel-pipe supply line for the City of Reading, Bureau of Water, was the removal of 8,355 cu yd of limestone.

The rock-removal, along the Schuylkill River at Reading, was handled by Berlanti Construction Company, Harrison, N. Y. The greater part of the drilling was accomplished with 1-in. hexagon and 1¼-in. round Bethlehem Hollow Drill Steel. Both carbide-insert bits and multi-use steel bits were employed. The approximate footage drilled was 4,000 ft, with the depth of the blast holes ranging from 4 ft to 14 ft. Drill steel fabricating and reconditioning was done by D. R. Buchert & Son, Inc., Reading, Pa.

For any type of rock-removal, you can always count on low-cost performance from Bethlehem Hollow Drill. This is because it is rolled from a special grade of steel which is resistant to fatigue. It has a wide quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow is furnished in rounds, hexagons and quarter-octagons, generally in lengths of from 18 ft to 25 ft. It also can be manufactured in longer lengths, to meet special needs. Use Bethlehem Hollow on your next drilling job. We think you'll like it.

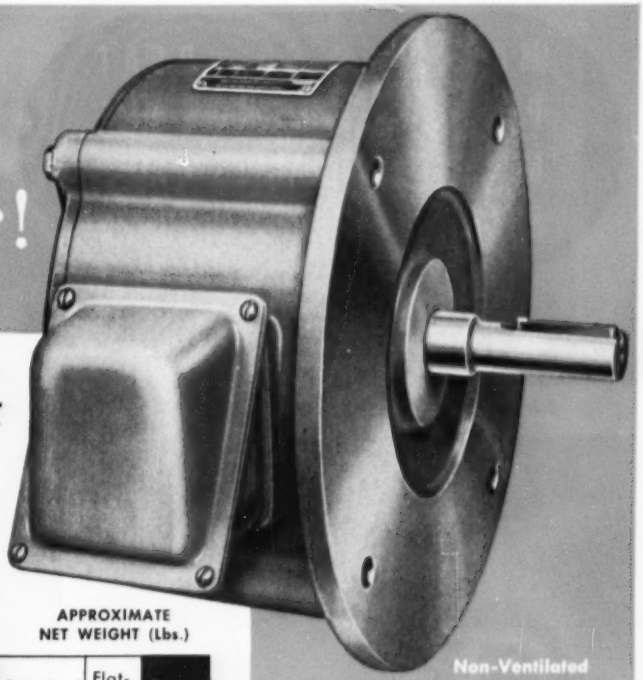
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

The Motor you asked for!



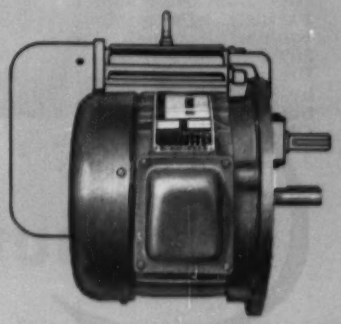
Non-Ventilated

TAKES less space ... because it's the new FLAT-Type Motor

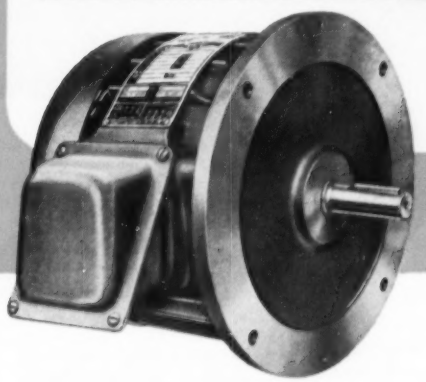
GIVES more service ... because it's a DIEHL

FOR SIZE AND WEIGHT, COMPARE THE NEW FLAT-TYPE WITH STANDARD MOTORS

FRAME SIZE		OVERALL LENGTH (Inches)			APPROXIMATE NET WEIGHT (Lbs.)		
Standard	Flat-Type	Standard	Flat-Type	Saving	Standard	Flat-Type	Saving
DIF 182	DIF 180	14 1/16	10 3/4	3 1/16	82	59	23
DIF 213	DIF 220	17 3/16	11 7/16	5 3/8	128	83	45
DIF 284U	DIF 280	26	13 13/16	12 3/16	272	135	137



New Flat-Type superimposed on standard motor



Fan Cooled

The unique and perfect answer in *integral motors*—designed especially for the machine tool and equipment industries. Packs full horsepower in less space . . . actually up to 48% shorter than standard motors without sacrifice in performance. Many pounds lighter, too, than conventional motors (over 50% in some cases), meaning vastly reduced over-hung weight. Standard radial construction, easy to disassemble and reassemble . . . no precision alignments or complicated air-gap adjustments to contend with. Totally-enclosed . . . no dirt, dust or moisture can get in. Available (non-ventilated) in ratings to 3 H.P., and (fan-cooled) in ratings to 20 H.P.

Perhaps the Diehl Flat-Type Motor is just what you need to solve your application problems. Give us the details and we'll be glad to submit recommendations. Ask for your copy of Bulletin CA-3461.

Diehl

DIEHL MANUFACTURING COMPANY

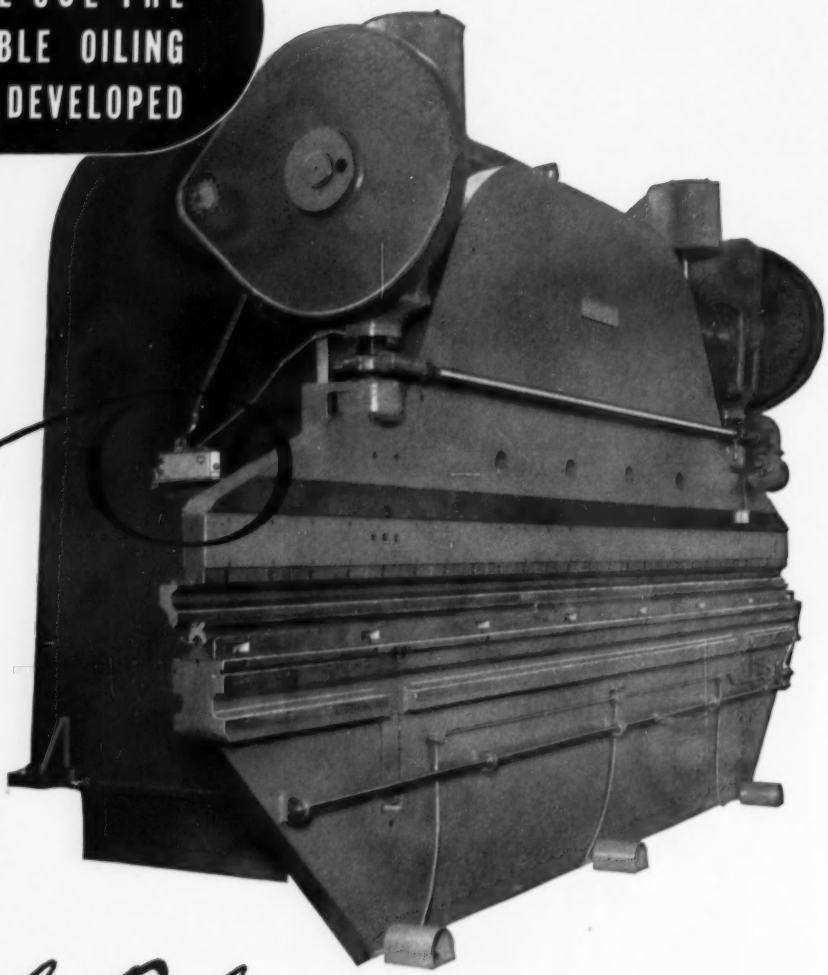
Electrical Division of THE SINGER MANUFACTURING COMPANY

Finderne Plant, SOMERVILLE, NEW JERSEY

ATLANTA · BALTIMORE · CHARLOTTE, N. C. · CHICAGO · CINCINNATI · DETROIT · MILWAUKEE · NEEDHAM, MASS. · NEW YORK · PHILADELPHIA · PITTSBURGH

Circle 4A on reply card

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a ⅜" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP

Fresh Oil . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

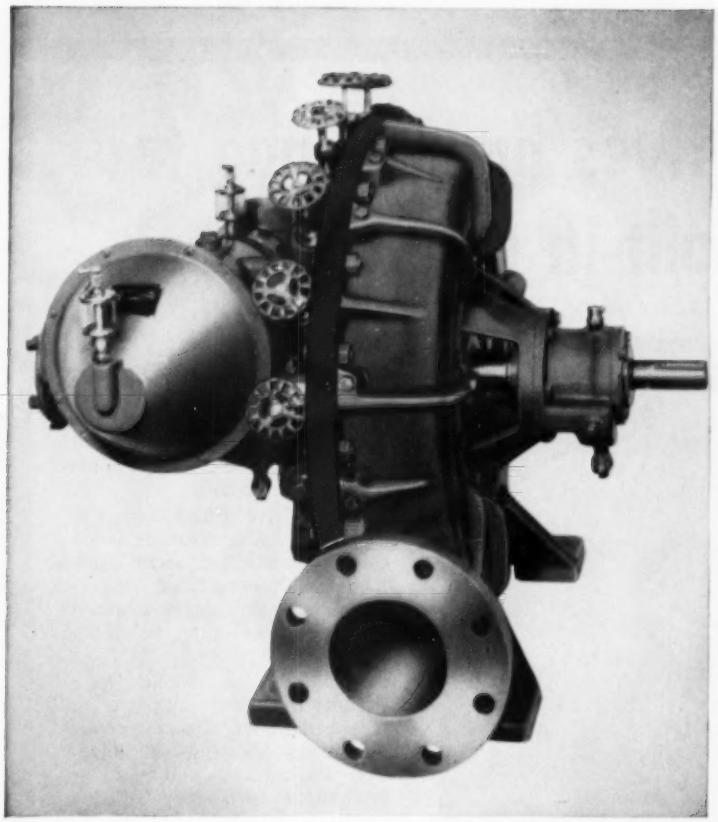
202 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

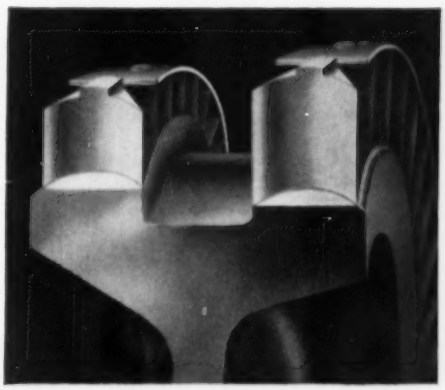
WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

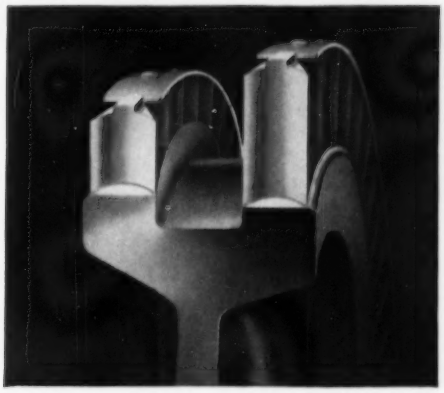
Circle 5A on reply card



This is the reliable Coppus Turbine furnished with either type of wheel



Wide bucket "L" type wheel



Regular type wheel

Top performance in all COPPUS TURBINES

Both the regular type wheel or wide bucket "L" type wheel give you Coppus proven high quality and low maintenance cost. The "L" type wheel is the new development for use where low water rate is essential.

Coppus "Blue Ribbon Turbines" earned their fine reputation right on the job. Users vouch for their top quality performance and their low maintenance cost.

In the words of the supervisor of a large chemical company: "Coppus turbines require so little maintenance that a person would starve to death, if he depended on it for a living."

Proven features of *all* Coppus Turbines:

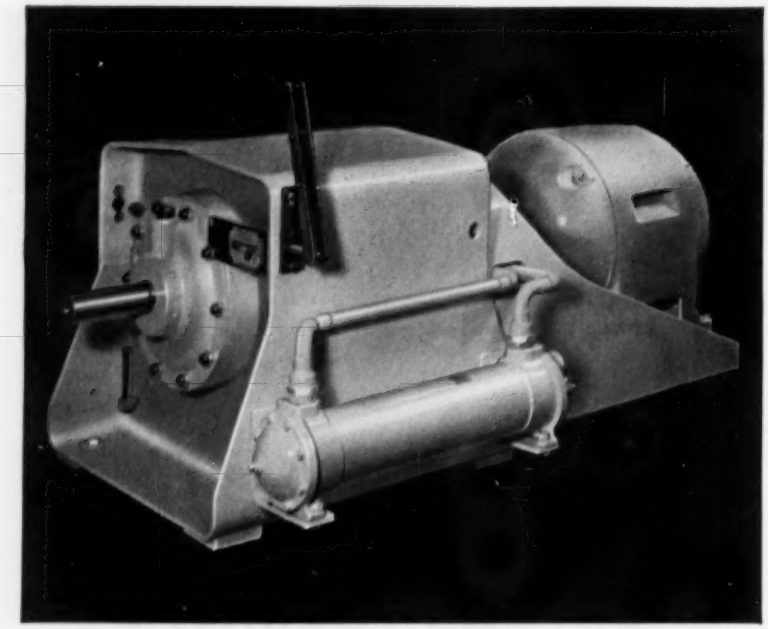
- Turbines rated close to your hp requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.

Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, *make turbine dollars go farther.* Send for Bulletin 135 on Coppus Turbines.

COPPUS ENGINEERING CORPORATION
206 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

Gýrol Fluid Drives limit torque to give you a built-in safety factor!



Type VS, Class 2 Gýrol Fluid Drive is available in ten sizes, 1 hp to 800 hp, speeds to 3600 rpm.

The American Blower Type VS, Class 2 Gýrol Fluid Drive not only offers adjustable, stepless speed control, but its inherent shock - absorption ability protects machinery.

For, a Gýrol Fluid Drive will limit the amount of torque which can be transmitted under overload conditions. This torque-limiting capacity can be adjusted by merely positioning the speed-control lever.

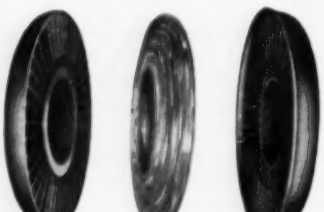
What's more, Fluid Drive permits the motor to come up to speed under almost no-load conditions—allowing simplification of motors and starting equipment for heavy starting loads.

You'll discover many more important benefits for a wide variety of industrial applications by calling our nearest branch.

FEATURES

- Can be reversed while in motion by reversing motor
- Across-the-line starting on many applications
- Motor can reach full speed before engaging load
- A compact, self-contained unit
- Trigger-action response — adjustable speed
- Speed may be controlled manually or automatically

Simple design, flexible operation



Runner Vortex of Oil Impeller

Gýrol Fluid Drive provides a simplicity of design and a flexibility of operation no other method of power transmission offers — plus an inherent safety factor. Operates on hydro - kinetic principle, using vortex of oil to transmit power from driving to driven machinery. Power is transmitted smoothly, evenly, efficiently, without shock.

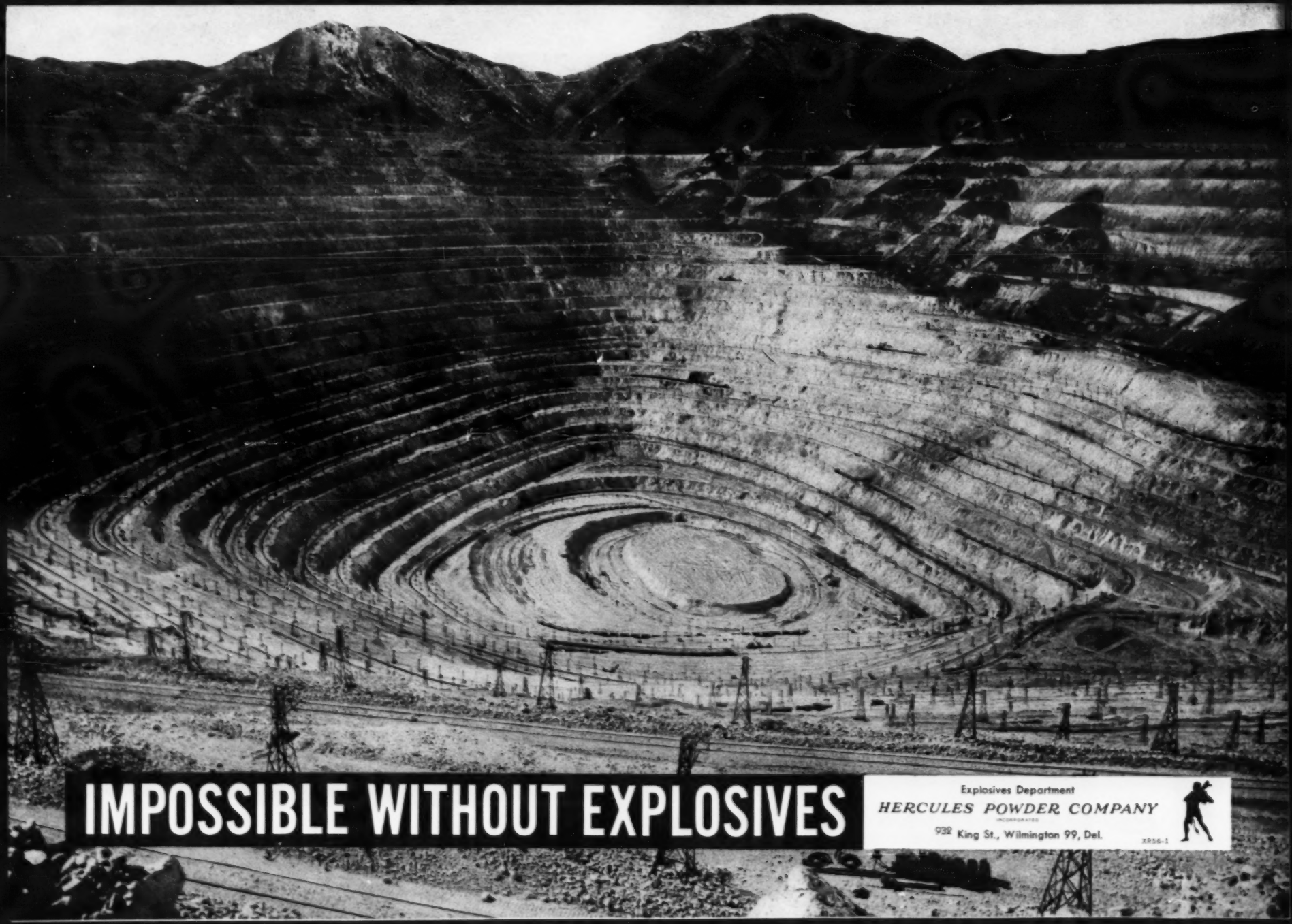
American Blower products serve industry

- AIR CONDITIONING, HEATING, VENTILATING EQUIPMENT
- MECHANICAL DRAFT EQUIPMENT
- INDUSTRIAL FANS AND BLOWERS
- CENTRIFUGAL COMPRESSORS
- GÝROL FLUID DRIVES
- DUST COLLECTORS
- REFRIGERATING MACHINES

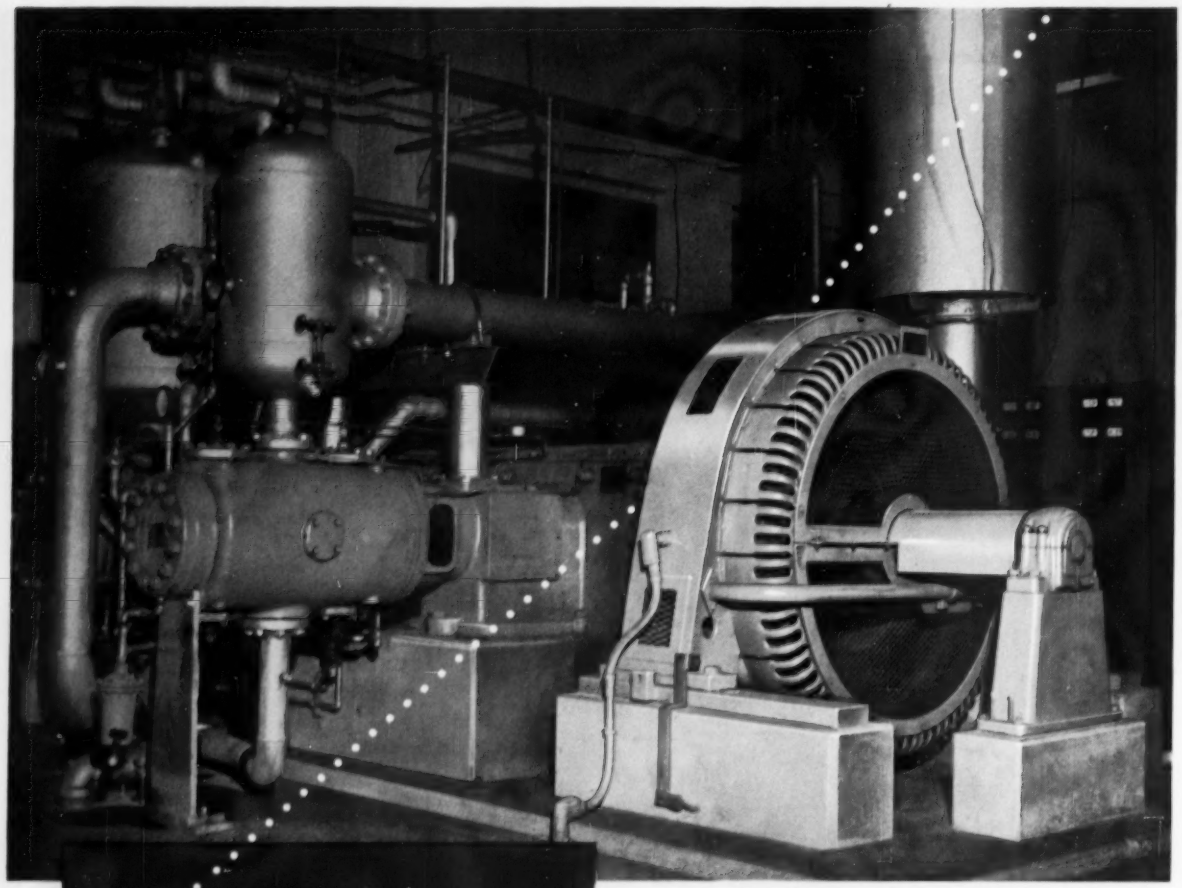
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American-Standard

AMERICAN **BLOWER**


IMPOSSIBLE WITHOUT EXPLOSIVES
Explosives Department
HERCULES POWDER COMPANY
INCORPORATED
932 King St., Wilmington 99, Del.
XR56-1

On big, important compressor drives, like this



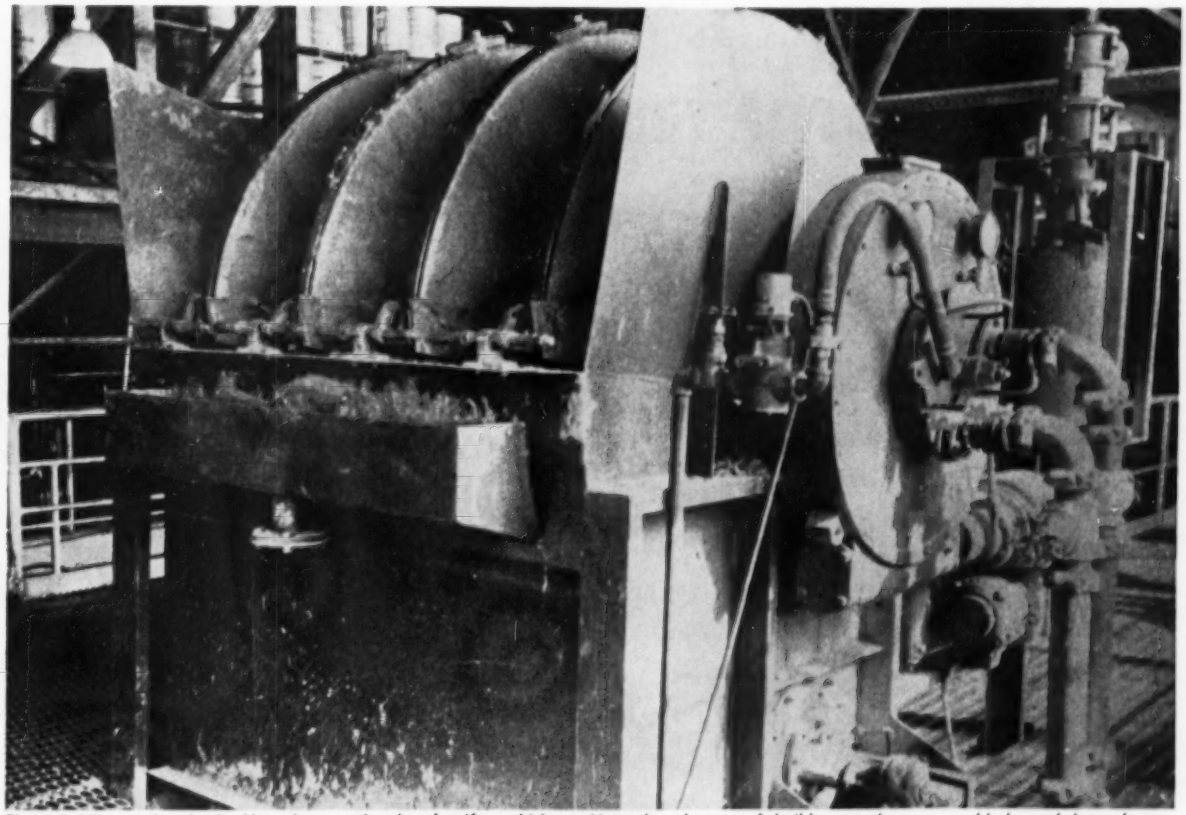
ELLIOTT SYNCHRONOUS MOTORS

ONE OF THE WORLD'S LARGEST SOOT BLOWER COMPRESSOR INSTALLATIONS is located in the famous Joppa Steam Electric Station of Electric Energy, Inc. There are six giant soot blower compressors, like the one pictured above – all driven by large Elliott 800-hp, 400-rpm synchronous motors. These motors are engine type with modern split-rotor construction. As is the case with all Elliott synchronous motor installations, the application of the motors was done with great care and consideration of all the complexities which accompany modern compressor drives. Elliott experience in compressor drives of all sizes and types is second to none, as attested by hundreds of successful installations. Ask your Elliott field engineer or write to Elliott Company, Ridgway, Pa., for full details.

ELLIOTT Company

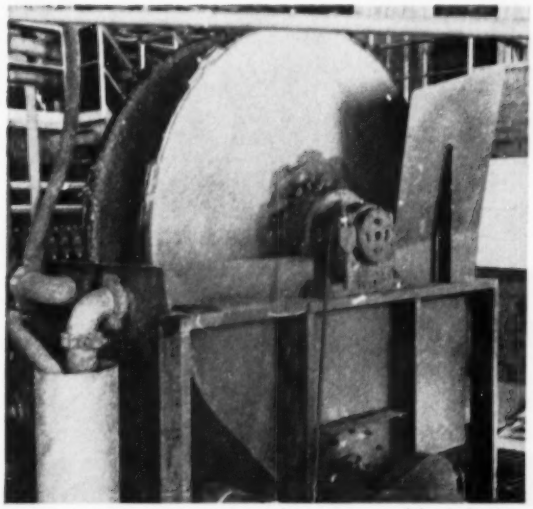
R6-7

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS



Eimco Agidisc on zinc circuit. Note the smooth cake of uniform thickness. Note the absence of buildup at the scraper blade and bag clamps.

LOW MOISTURE AT HIGH ALTITUDES WITH EIMCO AGIDISC FILTERS



Eimco two disc Agidisc type used on copper and lead circuits.

Metallurgical concentrates being dewatered in a mill at approximately 9,000 ft. elevation are handled on three Eimco Agidisc filters, one each for lead, copper and zinc circuits.

The ore is ground to 50%—200 mesh and dewatered on the Agidiscs equipped with snap blow device to provide maximum cloth life and tonnage.

Most important is the moisture content of these dewatered concentrates discharged from the filters at this altitude. The monthly average runs; lead 8.0%, copper 9.5% and zinc 10.3%.

Operation of these filters is best expressed in the words of the Superintendent of the mill who says, "their (Eimco Agidiscs) operation is so trouble-free that we have paid no attention to them and feel that when we get time from the other parts of the circuit we will undoubtedly be able to improve the present moistures."

Your problem in dewatering a metallurgical concentrate can be solved by Eimco's filtration engineers. Call on Eimco for the experience and facilities to solve your problem.

THE EIMCO CORPORATION

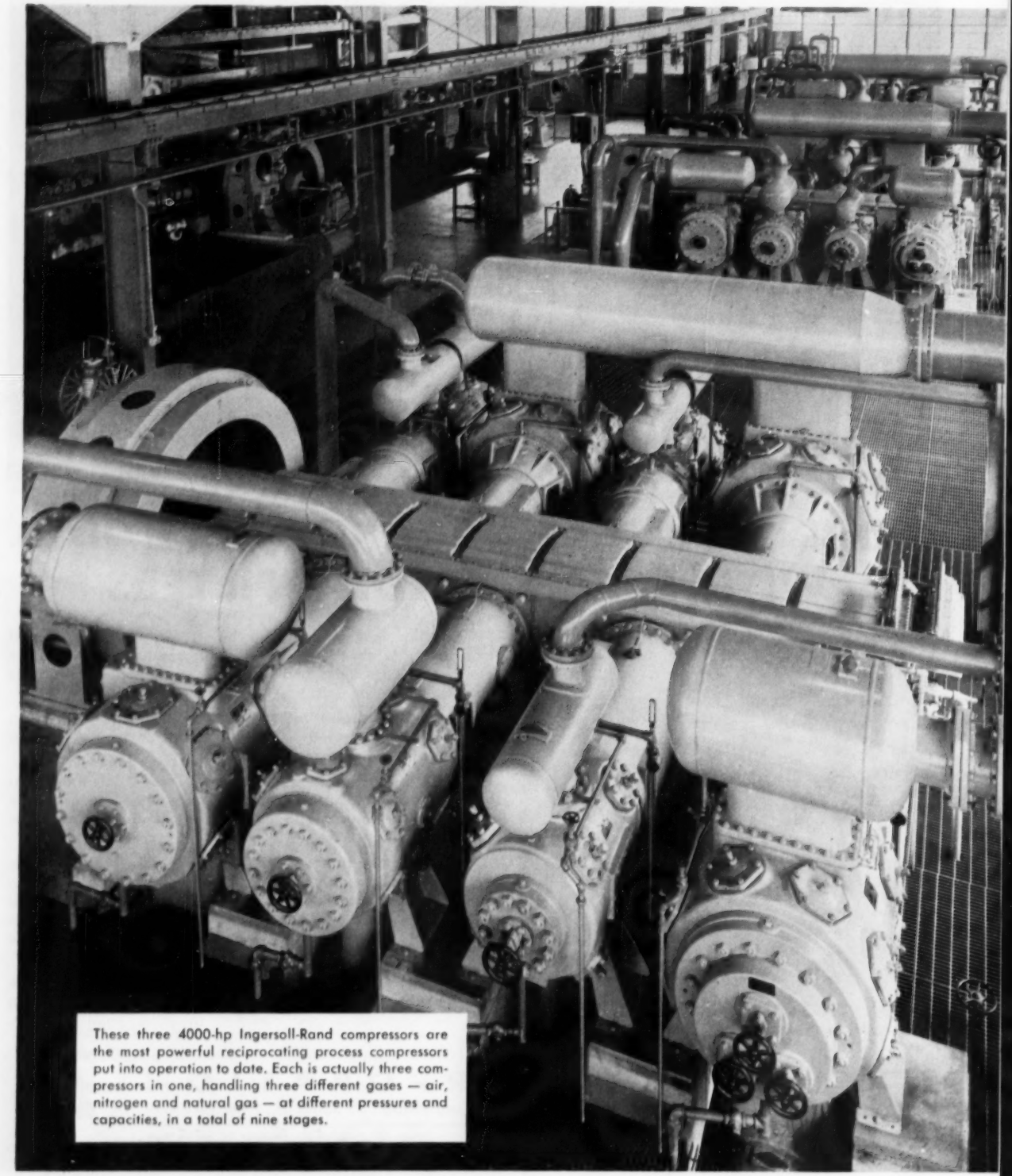
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-204

Circle 10A on reply card

COMPRESSORS help make



These three 4000-hp Ingersoll-Rand compressors are the most powerful reciprocating process compressors put into operation to date. Each is actually three compressors in one, handling three different gases — air, nitrogen and natural gas — at different pressures and capacities, in a total of nine stages.

AMMONIA

at Grace Chemical Company*

Huge plant at Memphis uses pressures up to 12,000 psi to produce 250 tons of anhydrous ammonia, 150 tons of urea a day

Compression plays a vital role in ammonia production and the nine Ingersoll-Rand compressors totalling 22,100 horsepower at the Grace Chemical Company plant are the backbone of their ammonia-urea processing.

Each of three 4000-hp units handles three separate gases at varying intake and discharge conditions in preliminary processing.

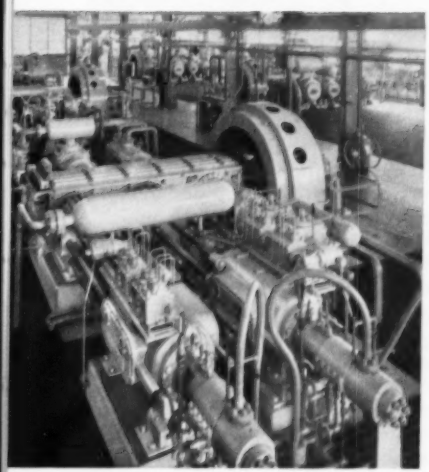
Three 3000-hp compressors boost the hydrogen-nitrogen mixture from 275 to 12,000 psi in five stages to feed the Casale converters.

A 900-hp HHE compressor discharges carbon dioxide at 3215 psi for combining with the ammonia to form urea by the Pechiney process.

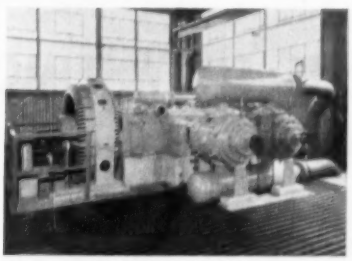
For a detailed description of the operation of this Grace Chemical Company synthetic ammonia plant, send for a copy of Form 3223.

This installation is typical of process plants of all types that use dependable Ingersoll-Rand compressors — whether reciprocating, centrifugal or combinations of both. Plant operators have found that these machines can be counted on to do their jobs efficiently, and with a minimum of attendance and upkeep. Form 3132 illustrates many such processes. Send for your copy.

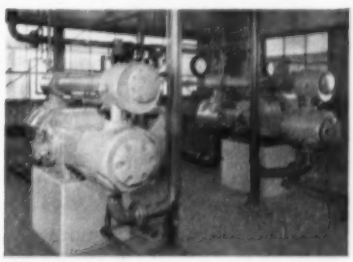
*Division of W. R. Grace & Co.



Each of these three 3000-hp HHE synthesis gas compressors supplies its own Casale converter with a hydrogen-nitrogen mixture at pressures ranging from 9000 to 12,000 psi, depending on the operating conditions.



Carbon dioxide, compressed to 3215 psi by this 900-hp HHE compressor, is combined with ammonia at 350°F in the Pechiney process, forming urea.



These two 100-hp PHE compressors discharge air at 100-115 psi. Pressure is reduced to 60 psi for general plant service and to 15-20 psi for operating automatic control instruments.

Ingersoll-Rand

1—402

11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS AND DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR AND ELECTRIC TOOLS

COMPETITIVE TESTS SHOW EIMCO ADVANTAGES

Recent competitive tests have shown again the superiority of Eimco equipment.

Tests conducted in timber and foothill brush were made to determine dozer earth moving and fire line construction ability.

Over a five day period numerous runs were made by impartial crews and judges with experienced operators using an Eimco 105 and a conventional tractor both equipped with bulldozers.

When final results were computed, the Eimco rated "Best" with 33% more dozer earth moving and 11% more fire line construction and the Eimco had also earned operator confidence because it was more stable, easier to operate and would back up 30% steeper grade (the usual method of getting out of trouble).

The features on the Eimco that contributed to its success in the test and outstanding performance under most difficult conditions were: front operator position, better visibility, rear engine mounting, better weight distribution, torque converter, better location and protection of cooling system, better maneuverability (through independent track control) simple controls which eliminate clutch pedals, steering clutch levers, master clutch and manual gear shift lever.

Eimco tractors with bulldozer or excavator attachments are demonstrating their superiority of performance and economy of operation on highways, construction jobs, in mines and in numerous other applications. See the Eimco Tractor before you make any decision on new equipment.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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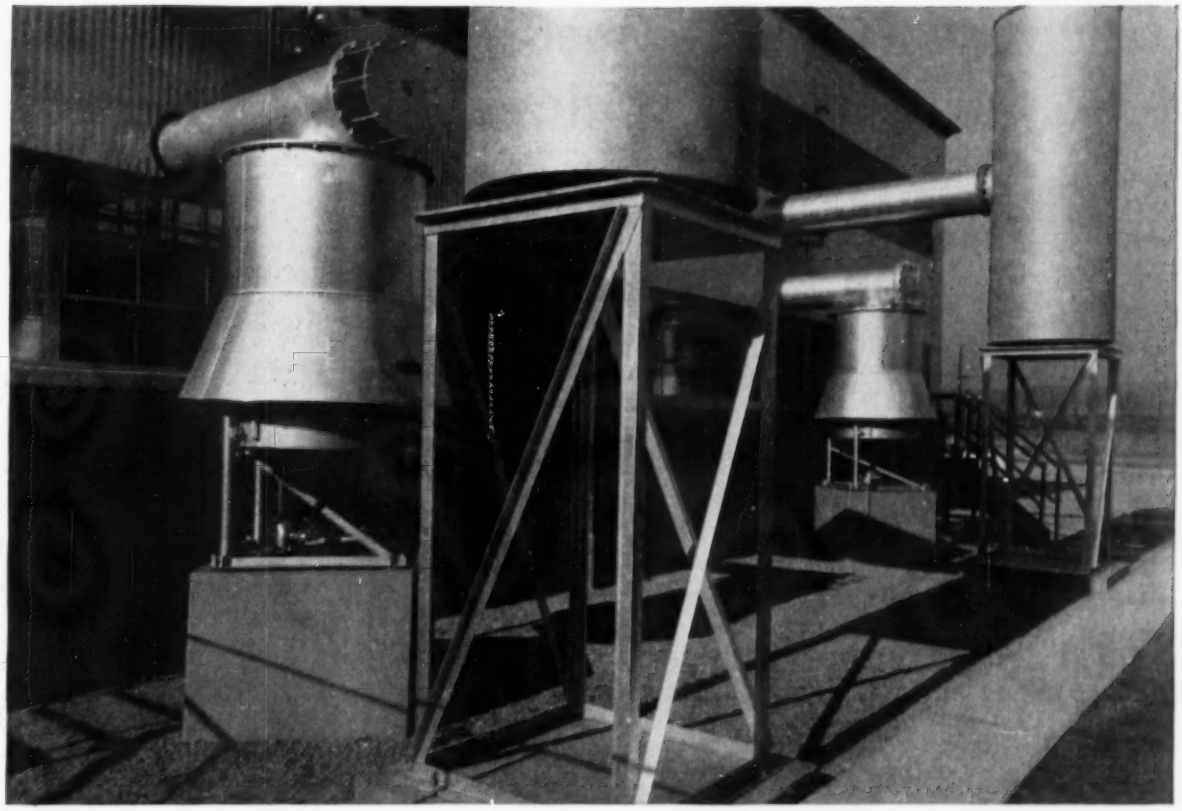
EIMCO

B-202



AAF Cycoils Type "P" protect Cooper-Bessemer engines from costly dust trouble at Sugar Grove, Ohio pumping station of Ohio Fuel Gas Company.

CYCOILS tell a *Sweet Story* at Sugar Grove

Ohio Fuel Gas Company is mighty particular about its machinery and equipment. They have to be. The big Cooper-Bessemer engines in this pumping station at Sugar Grove, Ohio, for instance, are the heart of the area's fuel gas supply. Dirty air could cause real damage.

What better reason for those AAF Cycoils Type "P" . . . protecting vital equipment, assuring uninterrupted flow of gas! Type "P" Cycoil utilizes a new principle in oil bath air filters—a perforated entrainment plate, placed in the air stream. Oil flows over the plate from a central distributing head. Metered orifices in the plate are calibrated to increase velocity of air flow through the openings to entrain the oil that tends to spill over the edges, and distribute air flow uniformly over the area. Entrainment accomplished, air then passes upward through primary and secondary filters for removal of dust and oil content. Result is air that's virtually 100% *dust-free!*

Here's the kind of protection your engines and compressors need. Protection that saves money, blocks trouble. You get it only with AAF Cycoil Type "P". So get the facts. Write for Bulletin 160.

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Cycoil Oil Bath Air Filters

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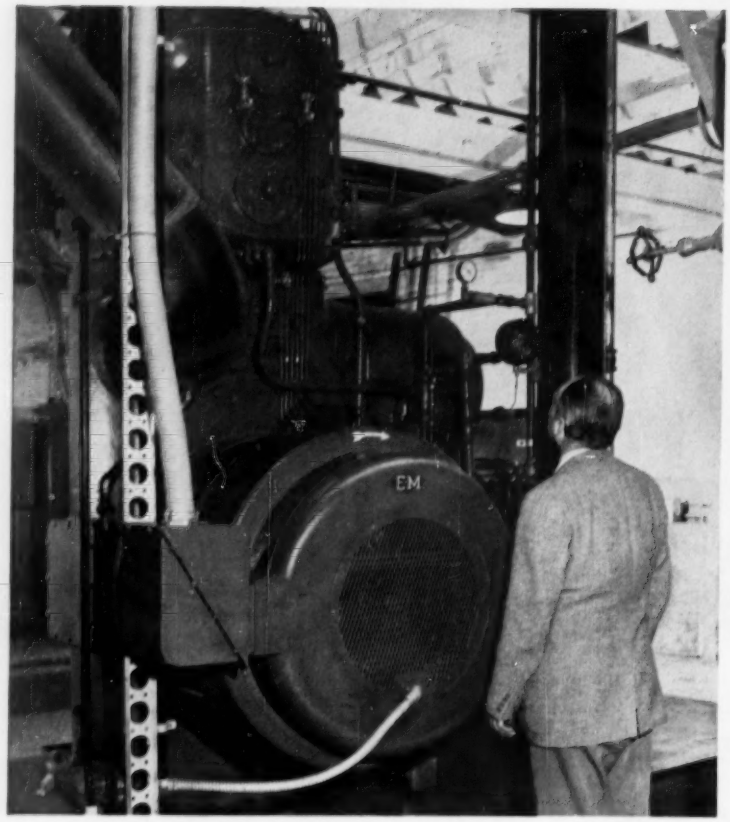
What control would you specify for a flange-mounted synchronous motor air compressor drive?



Paktrol efficiently controls this E-M 200 hp, 514 rpm, 1.0 PF, 440-volt Flange-Mounted Synchronous Motor at The Eberhard Company.

Here's why Eberhard chose the NEW **E-M** PAKTROL CONTROL

The Eberhard Company of Cleveland, Ohio, a division of Eastern Malleable Iron Company, selected an E-M Flange-Mounted Unity Power Factor Synchronous Motor to drive an air compressor in their plant. The compressor is unloaded at start and operates at standard load and speed.

Such characteristics meant that a simplified control could be used. A control having meters, field rheostat and a separate motor-generator set for field excitation was unnecessary.

Careful comparison by Eberhard of the new simplified E-M Paktrol Control with other type controls resulted in it being chosen for the features given below.

Features and Advantages of NEW PAKTROL CONTROL

1 Lower Cost — Wherever Paktrol can be used costs are saved two ways. Its built-in selenium rectifier lowers both initial and installation costs as compared to those of a separate synchronous motor control and motor-generator set.

2 Simple Operation — Start-stop pushbutton magnetic full-voltage operation with "conscious" control by the E-M developed Polarized Field Frequency Relay system.

3 Full Protection for Motor and Control — Relays protect against overloads, overcurrents, abnormally low line voltage, single-phase operation, or out-of-step operation. Fuses protect rectifier and transformer.

4 Minimum Maintenance — Static rectifier for d-c field excitation eliminates maintenance of brushes, commutator, and bearings of conventional rotating exciter.

Paktrol is available for use with unity power factor flange-mounted synchronous motors driving air compressors in ratings of approximately 75 thru 200 hp in applicable speeds of 720, 600, or 514 rpm.

Let your nearest E-M sales engineer show you how to get the best performance from your air compressor flange-mounted synchronous motor drive. Write the factory for E-M Paktrol Control Bulletin No. 220.

E-M

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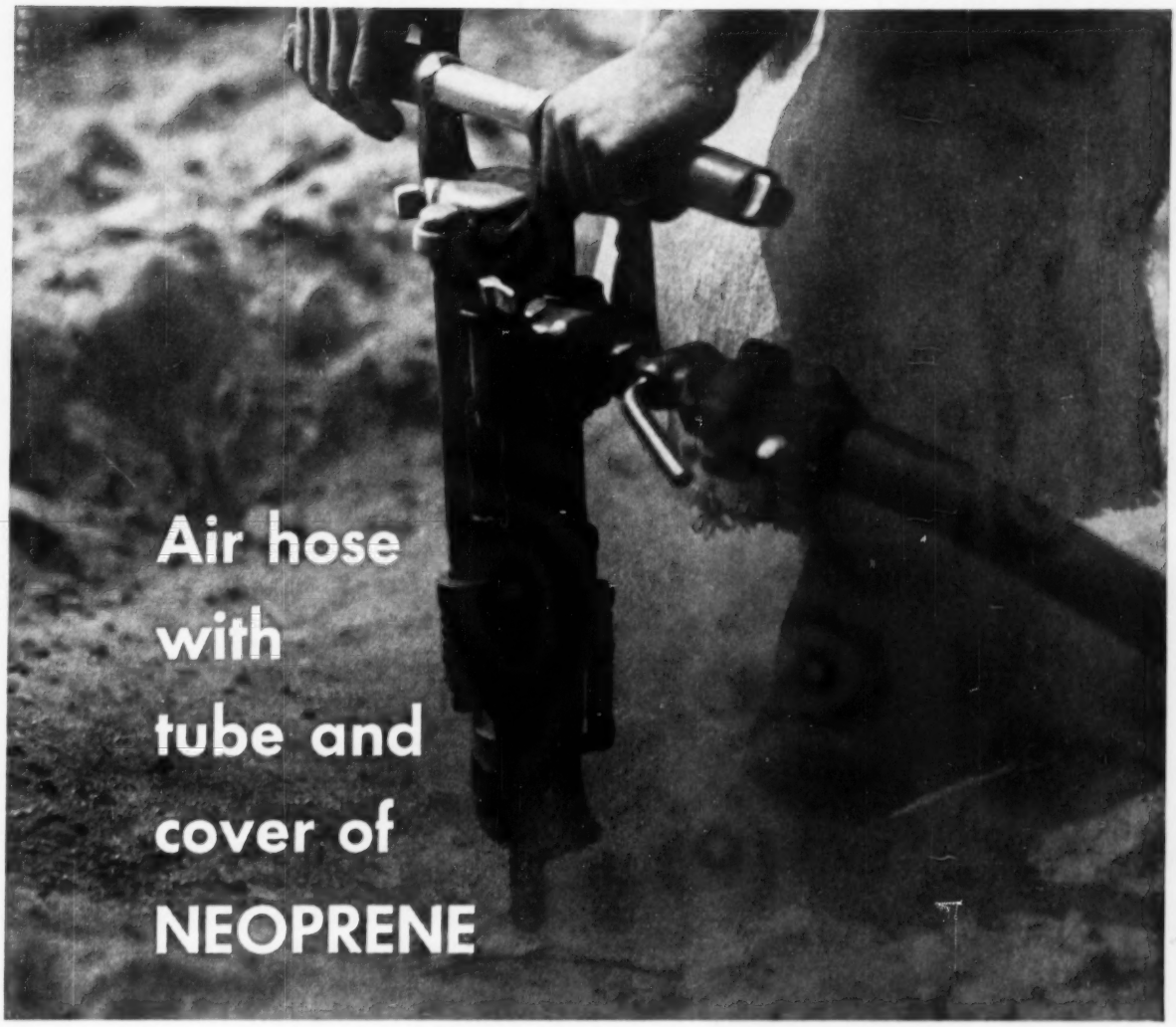

Here's a rugged hose that can cut your replacement costs

EXTRA PROTECTION inside and out—that's the secret of the long, cost-saving service life of air hose made with Du Pont neoprene.

STURDY HOSE TUBES of neoprene resist the lubricating oil present in the air supply. Neoprene won't get soft and sticky, or crumble off and plug tool parts.

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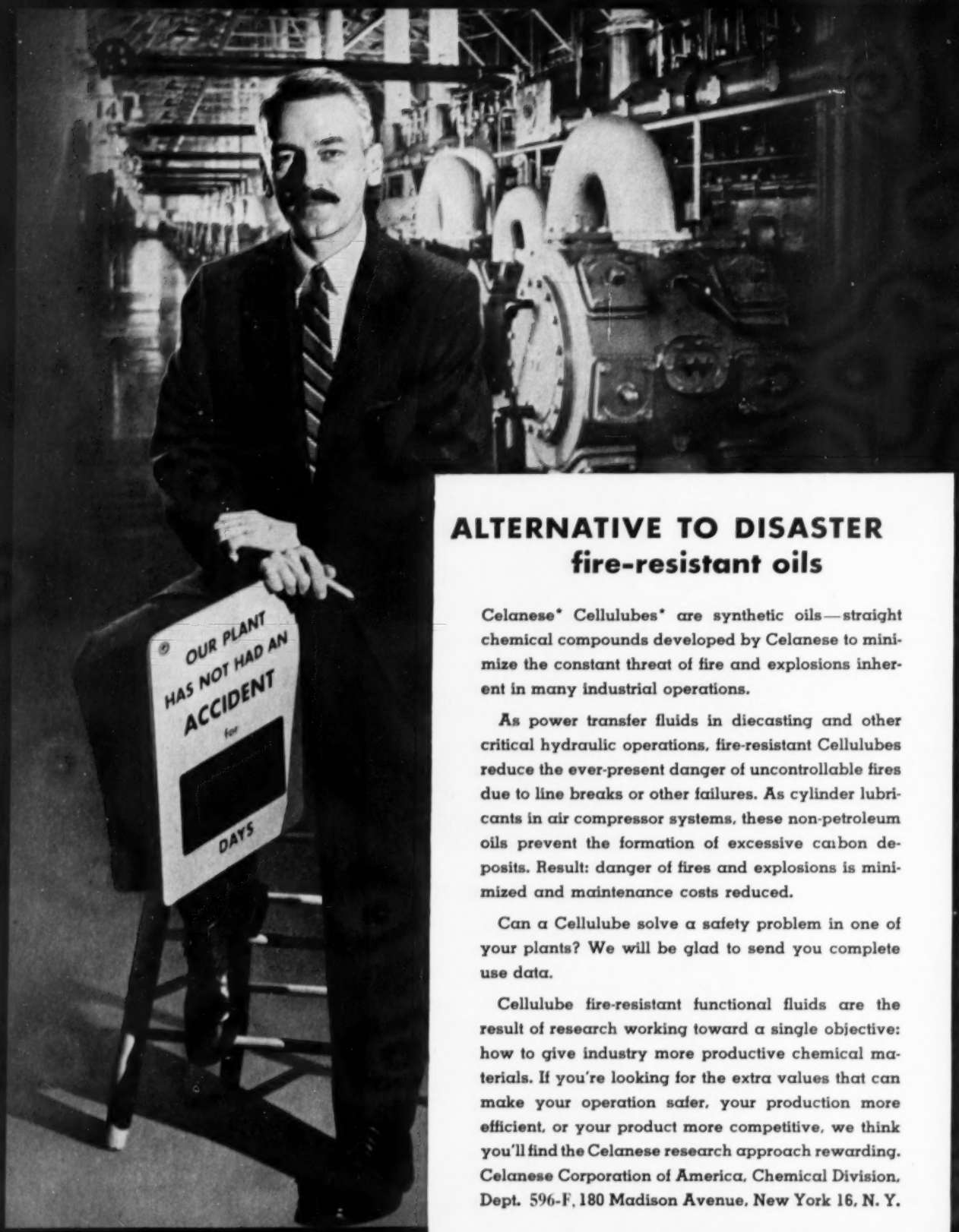

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Celanese* Cellulubes* are synthetic oils—straight chemical compounds developed by Celanese to minimize the constant threat of fire and explosions inherent in many industrial operations.

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ON THE COVER

THE extensive piping system of the Delaware Flying -A- Refinery includes lines to convey river water for cooling purposes to and from the plant and also others to carry off storm water. In our cover picture a workman strains to steer a mammoth piece of pipe into a trench as it hangs from a crane. In the background is a 285-foot guy derrick used to erect the converter column of a fluid catalytic cracking unit.

IN THIS ISSUE

ON A 450-acre Delaware tract (that's 70 percent of a square mile) 7000 men are bringing order out of apparent confusion as they knit together the largest petroleum refinery ever built from scratch. Less than two years ago crops were growing on the site; a year from now 130,000 barrels of petroleum will be processed there daily. The construction project is described in our first article.

•

CANADA'S northern frontier is slowly being rolled back. One by one, islands of human activity appear amid the great undeveloped expanse. One of the latest is the Beaverlodge section along the northern shore of Lake Athabaska. Like most of the others, the outpost owes its existence to mining. Its base-metal deposits, known for half a century, have been too lean to warrant working, but now the area is flourishing as one of Canada's major sources of uranium. Gunnar Mines is the big name among the producers. Twenty million dollars and several years of work were expended getting it into operation. Page 168.

•

TUNNEL-driving performances are difficult to evaluate because of the great variations in the drillability and soundness of rock, size of bore, etc. There is not just one tunneling speed record, but one for each size. Mannix-Stolte crews in British Columbia believe they have set a new mark for an 18x18-foot bore, and their claim seems to be justified. Page 174.

•

EFFICIENT rock drilling requires that cuttings be removed so the drill will always strike sound rock rather than pound upon a cushion of fragments. Another good reason for capturing the cuttings, large and small, is that rock dust becomes a menace to health when airborne. A discussion of modern dust-removing equipment starts on page 176.

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Delaware Flying -A-

TIDEWATER REFINERY

Largest Plant of Its Kind Ever Built at One Time Is Rising Fast on 5000-acre Tract; Will Process 130,000 Barrels of Oil Daily

ALLEN S. PARK

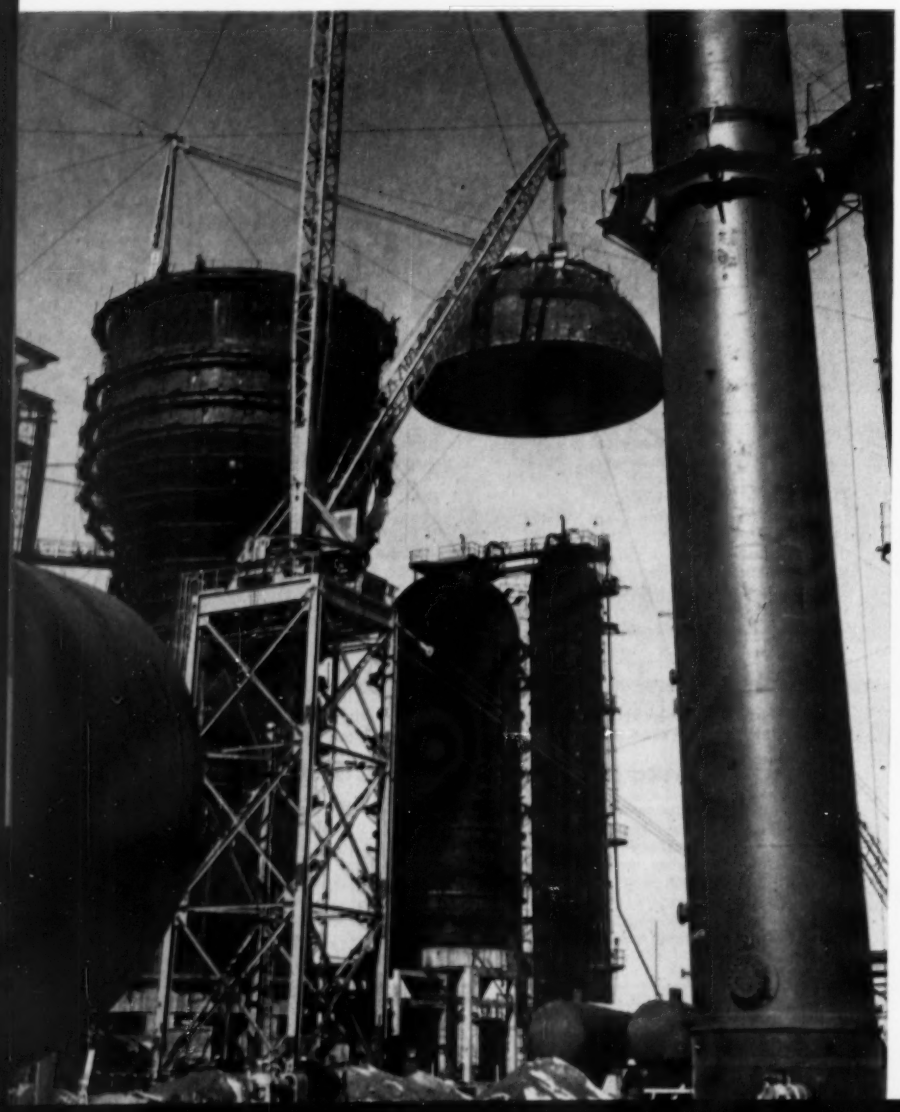
THE largest petroleum refinery ever built at one time is rising on a 5000-acre tract 15 miles south of Wilmington, Del. Called the Delaware Flying -A- Refinery, it will be owned and operated by the Tidewater Oil Company. Several units are scheduled for completion by the end of 1956. Designed as a flexible plant for the manufacture of a variety of products from any kind of crude oil, it will consist of eleven major processing units, storage tanks with a combined holding capacity of 7,000,000 barrels, an 8-building "business section" and 10 miles of paved streets. A mile and a half away along the Delaware River there will be an extensive marine terminal that will be connected with the refinery area by multiple pipelines for unloading and loading tankships.

The location of the refinery will permit crude oil to be brought in economically by water and afford excellent facilities for the fast distribution of finished products to eastern markets by water, rail lines and superhighways. It is accessible to unlimited supplies of water, which is indispensable for cooling services in the refining process. The site, which is one of the largest ever acquired for industrial purposes on the eastern seaboard, provides ample room for future expansion. It is on the fringe of the Philadelphia metropolitan district, and the new plant will make the Delaware Valley Area the nation's second largest oil-refining center, being exceeded only by the Texas Gulf Coast. When the Flying -A- and other plants now under construction are in operation, the area will be capable of processing about 850,000 barrels of petroleum daily.

The section was originally favored by oil companies because it was a good place from which to export their products, and then it was discovered that it was also an excellent refining location. Philadelphia is now the country's leading petroleum port with crude oil and its products, estimated at 75 million tons annually, making up three-fourths of the waterborne tonnage handled there. The city ranks high as a distribution center for petroleum products because 20 million people live within a 100-mile radius and the eight surrounding states have about one out of every four of the nation's motor vehicles.

Approximately 450 acres—roughly one-tenth of the Tidewater tract—will be built on at present. The main refinery units will be situated on a strip of about 1000x3500 feet running roughly parallel to the Delaware River, which is almost within sight to the east. Other facilities, among them the storage tank farm, will face this area.

The huge project, including engineering, is being constructed by C.F. Braun & Co, of Alhambra, Calif., on what the industry calls a "turnkey" basis. This means that when its forces depart they will leave behind them a complete plant,



CAPPING A CONVERTER

Putting a 200-ton head on the towering converter column of the fluid catalytic cracker took six hours and was one of the heaviest lifting jobs in the construction of the refinery. The steel dome, 59 feet in diameter at the base, is shown suspended in midair from two American 200-ton guy derricks supported on 6S-foot steel towers. With its top in place, the converter column is as high as a 20-story building. The pigmy figures of the workmen on the lip of the uncapped column give an idea of the size.

FROM THE AIR

Across the center of the picture is the main processing area. From left to right the rising structures are: the power station and stack, the fluid coker, the sulphur-recovery plant, the crude unit and stack and the catalytic cracker just right of the center. The first of the storage tanks are taking form in the middle distance. In the background is the Delaware River on which crude oil will arrive and some of the products depart.

ready for occupancy. Actually, some of Braun's personnel will remain a little longer to make sure that everything is running properly and to help Tidewater men get acquainted with the equipment and its operation.

Several of the processing units will be the largest of their kind. In this category will be the "crude" unit, a cluster of vessels and columns that will convert 130,000 barrels of petroleum daily into gas, gasoline, naphtha and other products for further refining. The Orthoflow fluid catalytic cracker, in which heavy fractions of crude oil will be transformed into high-octane gasoline and other products for further processing, will likewise be the biggest ever constructed. It will have a rated capacity of 102,000 barrels a day. Designed by M.W. Kellogg Company and built by Braun, it will differ from older-type fluid crackers in that its regenerator will be located on top of the reactor.

TWENTY-FOOT BLUEPRINTS

Last fall two machines were turning out 30,000 blueprints a week to guide the construction workers. If stacked, they would have made a 75-foot pile. A standing joke among the engineers was: "When the weight of the paper equals that of the refinery, the job will be done." Blueprint production is now tapering off, but the construction tempo is rising. The print shown is a flow diagram 20 feet long. Other office machines that expedite progress include an IBM computer that calculates 6500 pay checks in 50 minutes and one that prints 100 checks a minute.

The fluid coker, with a daily input rating of 42,000 barrels of heavy crude fractions, will have two functions. First, it will upgrade residual fuels into more valuable components of gasoline and heating oils; second, it will furnish fluid coke to be used as fuel to keep the refinery operating 24 hours a day. Most of this product will be piped under air pressure to the powerhouse where it will be burned beneath the boilers. The remainder will either be sold or fed to other heating equipment at a later date. Even the flue gases from the coker will be burned with supplementary fuel to raise steam. Only two fluid cokers have been built previously, the largest of the pair being only one-fourth the size of the newest one, which will rise to a height of 250 feet.

A vapor-recovery gas plant will handle up to 90 million cubic feet of light gas

daily from the crude-oil and gasoline processing units. A sulphur-recovery plant laid out by Ralph M. Parsons will be the biggest in existence. Among the other major refinery facilities will be a polymerization plant of Universal Oil Products design. Two of the business section's eight large steel-and-brick structures will house the general laboratories and one the administrative offices. There will also be an industrial-relations building, a pilot experimental plant, a change house for workers and a firehouse with trained crews on duty constantly.

On visiting the site, one is keenly aware of the complexity and mechanization of a huge modern, high-speed construction job. A recent Du Pont publication noted that its original mills, only a few miles away, were constructed by members of five crafts: surveyors, sawyers, carpenters, masons and blacksmiths. In startling contrast, a plant

HARD HATS OF VARIED HUES AND MARKINGS

Each of the many crafts wears an identifying helmet. Almost every color of the rainbow and a variety of stripes, crosses and polka dots bedeck their headgear. Boilermakers, for instance, wear dark blue, millwrights pink with white stripes, safety men yellow with an encircled cross in green. Above, a warehouse man is shown taping a black stripe on a white helmet to designate a concrete worker.

such as the new Flying -A- Refinery calls for the services of more than 100 engineers of different classifications, dozens of other kinds of technicians and not less than 25 types of craftsmen. These men are aided by scores of up-to-date machines, some of which do the work of

HIGHWAY OF POWER

This oversize ditch will carry part of the 48 miles of concrete ducts encasing 200 miles of underground electrical lines. Another 200 miles of overhead lines will supply current for the street and floodlights, telephone system, interior illumination, etc. The refinery will use as much power as a city with a population of 50,000.

PREDECESSOR OF TIDEWATER COMPANY

TIDEWATER Oil Company, one of the nation's oldest firms in the industry, is the outgrowth of a pioneer enterprise in the petroleum transportation field. The original firm, called The Tide-Water Pipe Company, Ltd., was organized in Titusville, Pa., in November 1878 for the purpose of laying a crude-oil pipeline. It was an unfavorable time to launch any venture concerned with petroleum because the price had declined from a high of $2.42 a barrel to 82 cents in the interval that had elapsed since Colonel Drake's epochal discovery.

A few pipelines were already in service, but none was bigger than 3 inches or longer than 40 miles, and all ran on level ground. Byron Benson, who had gravitated into oil production from the lumbering business in New York State, visualized a 6-inch wrought-iron artery carrying crude oil inexpensively over the mountains and to the eastern seaboard—hence the words "tide-water" in the company title. Joining him in the undertaking were his friend Robert Hopkins, who had been a major during the Civil War, and David McKelvy, a young Titusville lawyer.

The townspeople were sure the idea wouldn't work, and even Benson wasn't too confident because it had never been tried. Throughout the cold, wet winter crews strung the pipe, and by May it had reached Williamsport, Pa., 104 miles away. On May 28, Benson turned steam into a 40-hp Holly engine and it began to operate the pump. Seven days later oil was pouring into storage tanks at Williamsport. The populace was astounded, and newspapers in New York City called the achievement "the feat of the age."

By stages, the pipeline was extended, first to Tamenend, Pa., and then, in

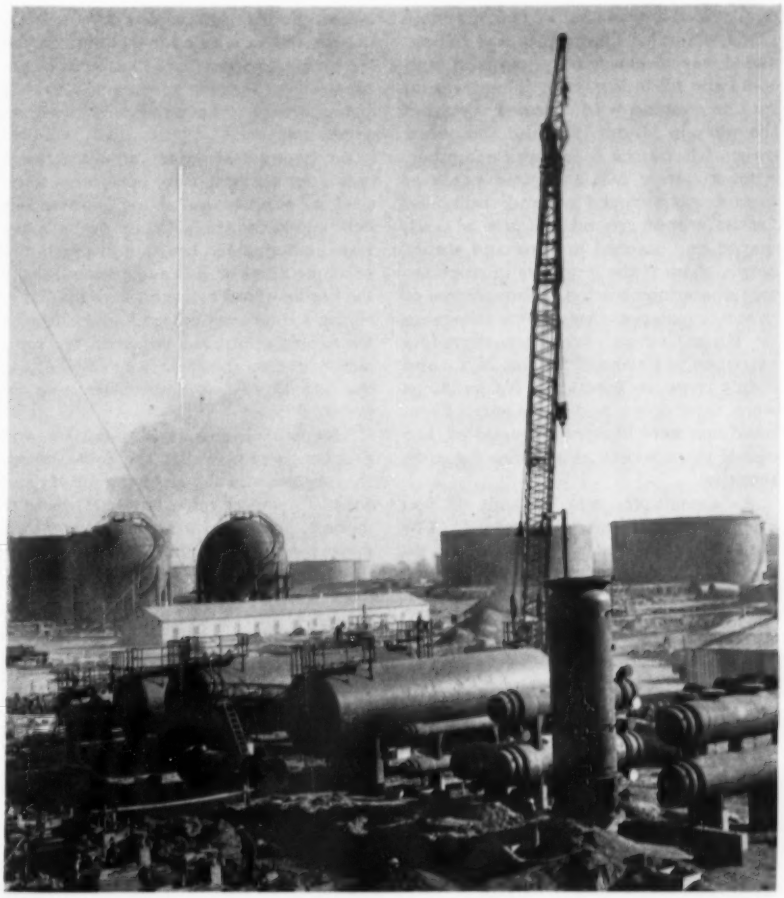
many humans; but it is obvious that human skills and brains are still essential to such undertakings.

Any engineering-construction organization is made up of two teams—one in the home office and the other in the field. The home-office organization consists mainly of engineers, designers, draftsmen, schedulers and the purchasing staff. They are the planners and visualizers who conjure up vast plants on paper and place orders for equipment they may never see. They turn their blueprints, specifications, schedules and instructions over to the field organization which transforms the lines on paper into buildings and equipment.

C.F. Braun & Co did the engineering, designing and planning for this enterprise in its California headquarters. While most of its projects have to do with petroleum processing, an appreciable and growing proportion is in the chemical and ore-processing industries. The firm operates the world over and has more than 10,000 employes, the total of course being subject to variation from time to time. On the Tidewater job it has approximately 125 staff engineers and supervisors. The rest of the army of workers has been recruited along the eastern seaboard, some coming from points several hundred miles away.

Aside from its own activities, Braun delegates certain specialized work to subcontractors. Their number fluctuates, but has ranged around five most of the time. When the site was visited, the subcontractors' labor forces varied from four to 260 men each. All told, there were 7300 on the Braun payroll and the number was still rising.

One of the first subcontracts—leveling the construction area—was carried out by George M. Brewster & Son, of Bogota,



BEGINNING OF GAS PLANT

This cluster of pumps, vessels and heat exchangers forms the nucleus of the gas plant. Looming overhead is a mobile crane used to hoist heavy parts into place. In the background are some of the oil storage tanks and two Hortonspheres that will hold liquid butane under pressure. The largest oil tanks, 56 feet high and 160 feet in diameter, will store 200,000 barrels each.

BUILT FIRST CRUDE-OIL PIPELINE TO ATLANTIC SEABOARD

1887, to Bayonne, N. J., where the company, through interim growth, had come into possession of a refinery. In 1888 this plant and other holdings that had been acquired in the meantime were brought together with an independent refiner, Lombard, Ayres & Company, to form a new company—Tide Water Oil Company. Before long it was more important than the initial concern, and in 1907 became the parent company.

Through the Associated Producers Company, a small Pennsylvania firm bought in the 1890's, expansion westward took place, and by 1913 interests had reached the mid-continent and included 2000 producing oil wells. In 1909 the original pipe line was extended 546 miles into Illinois and used to transport oil from there to the Bayonne refinery.

Meanwhile oil had been discovered in California, and in 1901 forty concerns were merged into the Associated Oil Company which became a producer, refiner and transporter of petroleum and its products. Among other things, it put together the largest pipeline system in the West, built a refinery at Avon in the San Francisco area, developed the Ventura Avenue Field near Los Angeles that is still a producer after 35 years of operation and persuaded the Southern Pacific Railroad to use oil instead of coal in its locomotive boilers.

Tide Water Associated Oil Company was created in March 1926 as a holding company to acquire control of the Tide Water Oil Company and the Associated Oil Company, the combined interests of which covered a good part of the country. In 1936 it became an integrated operating company, engaged in all phases of the petroleum business. On May 3, 1956, the name became Tidewater Oil Company.

It now has four operating divisions: the Eastern, with headquarters in New York, covers the thirteen middle Atlantic and New England states and the District of Columbia; the Central, with headquarters in Tulsa, Okla., and the Southern, with headquarters in Houston, Tex., operate in the mid-continent states; and the Western, with headquarters in San Francisco, embraces the Pacific Coast and several other western states, Hawaii and the Philippine Islands. The divisions market the company's Flying -A- gasolines and Veedol motor oils and lubricants.

The operating refinery at Avon, Calif., has a through-put capacity of about 95,000 barrels daily. Upon completion of the Delaware Flying -A- Refinery, Tidewater's total refining capacity will be raised to approximately 225,000 barrels a day.

N.J., which moved about 3,000,000 cubic yards of earth. The terrain was rolling, and it was necessary only to lop off high spots and fill in low ones. There was no rock to contend with. Brewster started the work in March 1955 and completed most of it by the following September. Approximately 500,000 cubic yards of topsoil was stripped off and stockpiled for use later on ground that is to be landscaped and planted to grass and shrubbery. Most of the land was in crops before operations started. Though free of towns or villages, there was a college on it—Kings College—which transferred its activities to Briarcliff Manor, N.Y., and didn't cease to function. Its buildings were torn down and salvaged. Farm buildings were likewise disposed of, but one of them served as an office for some months.

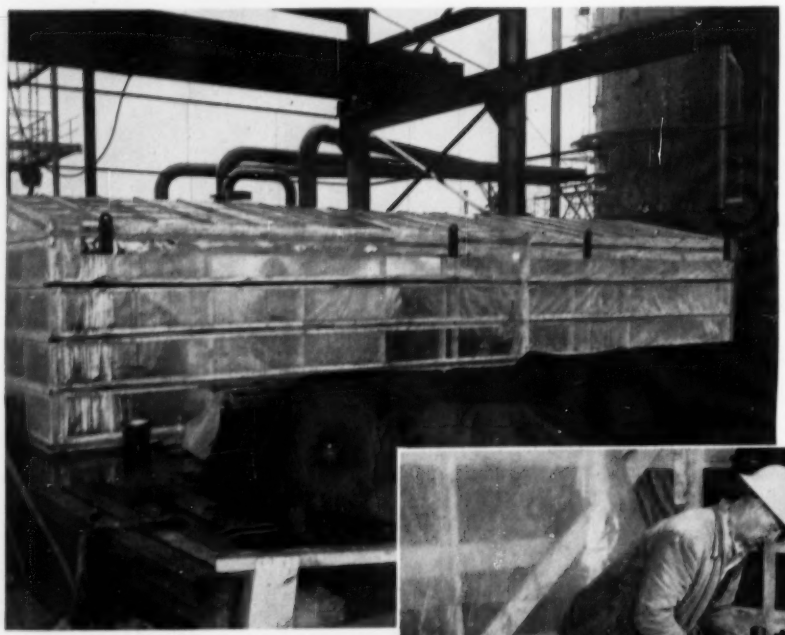
As graded, the site is about 60 feet above sea level and well drained. The subsoil is solid and there have been no unusual foundation problems. However, the surface didn't stay level long. In the course of the operations thousands of excavations of varying sizes have been dug and assorted earthmoving machines have come into play.

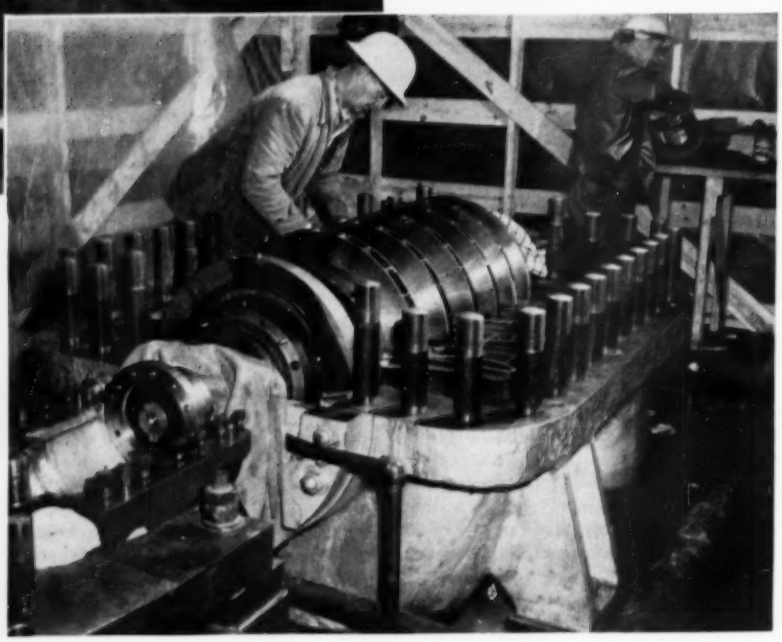
Beginning last June, advance-guard crews put up temporary structures to be used as contractors' shops, warehouses and headquarters. Other preliminary tasks included the creation of truck-dispatching areas as well as parking lots for the hordes of workers who were to follow, laying a mile-long railroad spur through the construction area and erecting a temporary pier on the river front to facilitate the handling of equipment arriving by water.

Meanwhile, incoming materials and supplies were stored in the fields, where they looked strange amid the alfalfa and corn. Those stockpiles have continued to mount. To the uninitiated observer they present a scene of utter confusion, but actually they follow a prearranged pattern, with fork-lift trucks and cranes depositing each item in its allotted place. The largest pieces, such as sections of the refinery towers, are barged up the Delaware to a temporary pier and hauled from there to the site. Some weigh as much as 100 tons each. Up to the first of this year 1200 carloads, 14,000 truckloads and fifteen barges of freight had been delivered. For the entire construction period the expected totals are 9600 carloads and 70,000 truckloads.

Erection of the larger petroleum processing units calls for the services of many lifting machines. The heaviest loads are handled by four of Braun's stationary guy derricks of 200 tons capacity. Working from atop structural-steel towers 65 feet high, they reach as much as 315 feet up in the air. Two portable gin-pole derricks, fifteen 50- to 60-ton crawler- and truck-mounted cranes, and a fleet of small hydraulic cranes are also in use (more than 100 cranes in all). One of the problems on a rush job of this magnitude is preplanning to provide room amid the rising vessels, pipes and other facilities for all the equipment and for men to work. To minimize congestion, Braun engineers made carefully detailed planning schedules for each section and operation. A scale model helps to spot construction machinery to best advantage and anchor-derrick guy wires where they will interfere as little as possible.

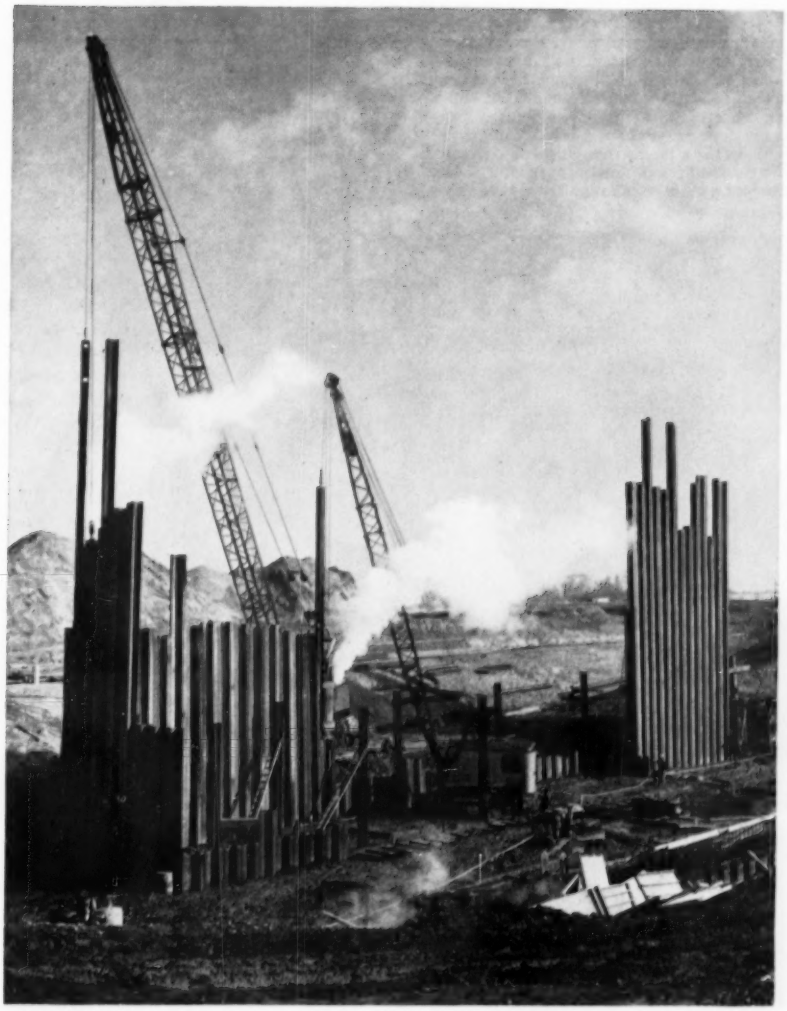
To keep the heavy construction equipment in running condition with the least down time four service trucks roam the area continually, replenishing oil and gasoline supplies, greasing, changing tires, etc. Each vehicle carries a small air compressor. There are about 900





PLASTIC TENT FOR BLOWER ERECTION

Centrifugal compressors will transfer great volumes of air and gas in the refinery operations. Among the nine Ingersoll-Rand turboblowers being installed is one of unusual size that will serve a catalytic cracker. It will compress 163,000 cfm of air to 15.3 psi pressure and be driven by an 11,250-hp steam turbine. As last spring was unusually cold and damp on the eastern seaboard, blowers being erected in the open were protected by tents of translucent polyethylene plastic supported by light wooden framework (above). Infrared lamps inside kept the air dry to prevent condensation of moisture and consequent corrosion. The view at the right shows the lower half of the casing and rotor of a multistage gas blower during its assembly.



SITE OF PUMPING STATION

Here steel piles are being driven in low marshy ground at the edge of the Delaware River to support a pump station that will supply cool water to heat exchangers at the refinery 1½ miles away.

pieces of rolling equipment on the job, ranging from passenger automobiles and pickup trucks to earth-moving units and cranes. Repairs that cannot be attended to in the field are done in a shop that is staffed by 25 mechanics in the daytime and ten at night. Air tools such as impact wrenches and grinders make their work easier and faster.

The refinery will require an unbelievable quantity of piping of numerous sizes, and part of it is being buried. Each barrel of crude oil or partly processed liquid will have traveled nearly 250 miles by the time it reaches the storage tanks. Incoming crude leaving the tankers will flow to the refinery at ground level through a broad pipeway containing sixteen separate lines ranging from 4 to 30 inches in diameter. Finished products will flow back to the piers through the same pipeway. Other lines will convey water, compressed air and steam to service the dock area.

Forty miles of piping will connect the tanks where crude oil, semifinished and finished products will be stored prior to processing or shipment. An overhead oil pipeway 40 feet wide with 50 miles of lines up to 36 inches in diameter arranged in three decks will run the length of the refinery and feed all the processing units from which another pipeway 70 feet wide and holding 32 miles of lines will extend to the storage tanks. One hundred miles of piping of varying sizes will carry fluids and products within the processing units themselves. These will interconnect pumps, heat exchangers and other process equipment.

To facilitate making the countless fabricated pipe spools and bends required to join the piping for these extensive networks, a special shop was set up in the refinery's business district. Up to 1000 units per week are produced there, the pipe being handled by air hoists during the operations. This structure will remain in place and be used by the refinery as a maintenance shop.

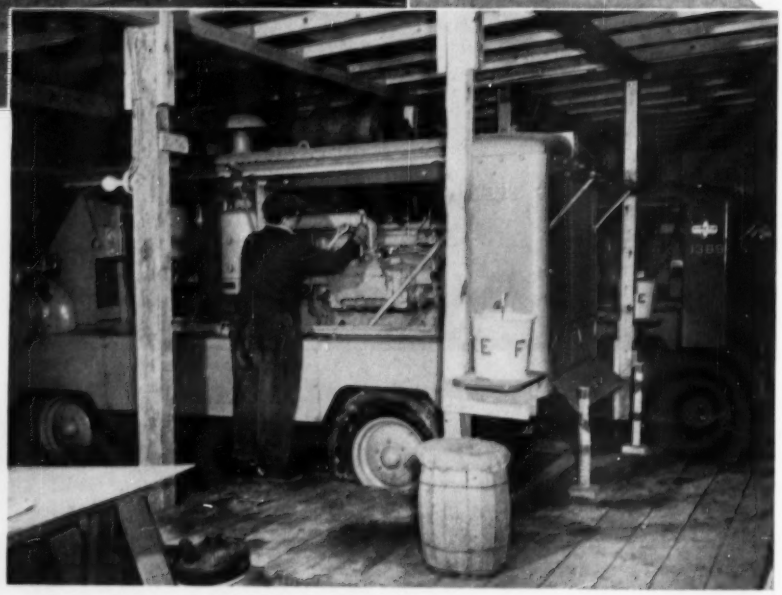
The 7-million-barrel storage tank farm is being erected by the Chicago Bridge & Iron Company, the tanks consisting of steel rings being joined, tier by tier, by automatic welding machines. As this area is beyond the limits of the air distribution lines, portable compressors serve its needs.

Activity at the marine terminal being created along the Delaware River rivals that at the refinery site. American Dredging Company is excavating a channel 400 feet wide and 12,000 feet long that will skirt the west side of Pea Patch Island

GROUND-LEVEL PIPEWAY

A welding team seals a junction in a 30-inch-diameter crude-oil line in the pipeway running from the piers where tankers for the refinery will dock.

Three Ingersoll-Rand Gyro-Flo portable compressors (bottom picture) constitute a central plant that sends 1800 cfm of air through a mile-long, 6-inch distribution system that is tapped at many places. Numerous other portable units of varying sizes are spotted close to air-powered operations. More than 850 pneumatic tools are on the job. All excavations in the main construction area are backfilled and tamped, as shown at the right, to prevent subsidence. Below, a Multi-Vane drill is being used to put bolt holes in the base plate for a motor that will drive a centrifugal pump destined for use in the water-treatment plant. The picture was taken in one of the yards where stockpiled equipment awaits installation.



and permit the world's largest tankers to make their way from the main river fairway to the docks. The 10 million cubic yards of silt being removed from the bottom by suction dredges is being deposited along the waterfront to raise 700 acres of marshland to a height of 12 feet above sea level. Near the pier area the channel will be widened into a turning basin.

Three T-head piers extending 2800 feet along the ship channel are being constructed by Frederick Snare Corporation of New York, which also designed them. Their 8-inch decks, cast in sections near the riverbank, are being placed on piling. The piers will be equipped for pumping crude oil from tankers to the refinery at the rate of one million gallons per hour. Finished products will likewise be piped to the dock and into ships' holds. Automatic winches will be installed to handle hose lines.

Tidewater added four new tankers to its fleet in 1954 and two in 1955. Six more will be ready by the time the new refinery swings into action. Four in the latter group will each have a capacity of 50,000 tons (equivalent to 350,000 barrels) and two will carry 45,000 tons or 300,000 barrels. All these vessels will be turbine-driven at speeds of at least 16 knots when laden.

Cooling water for the plant will be taken from the bottom of a 40-foot channel that is being dredged in Cedar Creek where it enters the Delaware so as to provide the coolest possible water obtainable. A pump house being erected there will house nine 2000-hp units that will account for one-third of the refinery's total electrical consumption. They will push the water through two 78-inch mains up a 55-foot rise to the refinery and then circulate it through 15 miles of smaller piping to the various condensers and other cooling devices. The water will be screened and chlorinated to protect the equipment through which it passes. None of it will be wasted, and substantially all of it will be returned to the river after it has served its purpose. On the way it will go through separator basins and over three subterranean artificial falls to check the force of its plunge.

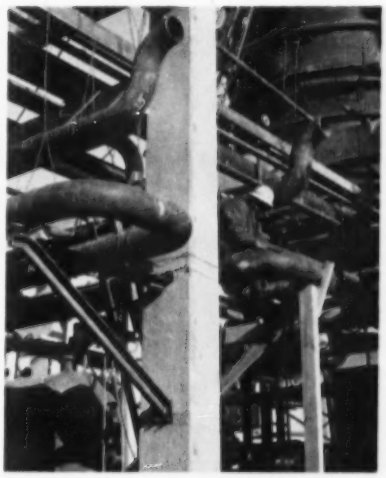
Compressed air is being used so extensively on the project that there are between 30 and 40 portable compressors of different sizes on the site. Braun alone has thirteen 600-cfm and thirteen 315-cfm Ingersoll-Rand Gyro-Flo rotary units and Tidewater will retain one 600 and one 315. Three of Braun's 600-cfm machines have been grouped under cover at a central point and discharge into a 6-inch line that runs for a mile north and south through the construction area and has 4-inch take-offs. In addition, single portables are spotted here and there to furnish air for tamping backfill into ex-

cavations, vibrating concrete, guniting, etc.

Although most of the processing vessels and the storage tanks are being assembled by welding, air-operated tools are depended upon heavily in carrying out various phases of the construction program. An inventory taken a few weeks ago showed that there were on hand approximately 850 Ingersoll-Rand units of different kinds. Among them were 63 grinders, 93 chipping hammers and 114 scalers, most of which are utilized for finishing and smoothing welds. It is significant that instead of riveting hammers, which are barely represented, there are 49 Impactools which are, in part, being employed to run nuts on alloy-steel bolts used in fabricating structural steel. Some of the 187 quarter-inch air drills listed are also serving to make bolt holes.

All over the construction site countless excavations are continually being dug for the installation of subsurface piping and equipment. Much of the time the ground is loosened with pneumatic diggers or clay spades, of which 121 are available. It is essential in such cases that the original surface be restored and the ground well packed, as most of these areas will subsequently be paved or planted. Consequently, all the openings are backfilled with specially compounded earth containing enough clay to insure firm consolidation. It is compacted with pneumatic tampers, and there is so much of this work that 41 units of the 32-pound type and 119 of the 47-pound models are in use.

Large quantities of concrete—more than 120,000 cubic yards—are required for foundations and footings throughout the site. All of it is vibrated in the forms and 49 air-powered tools are available for the purpose. A dozen Utility air hoists are on the job for lifting light materials to high places and for handling pipe in the shop previously mentioned.



PIPE PATTERNS

One of the many mazes of pipe that look to the casual observer like pipefitters' pipe dreams. This one forms part of the 250-mile circulatory system through which 130,000 barrels of crude oil will flow daily when the refinery is in full operation. A special shop was set up to make pipe bends.

UNDERGROUND WATERFALL

This concrete structure, which will be buried and unseen, will act as a brake on the force of storm drainage water flowing downgrade to the Delaware River. Water entering through pipes at the top will drop 20 feet to the bottom, then flow on through pipes to be connected at the two openings shown. A similar water drop will be incorporated in the 7-foot-diameter return line of the refinery cooling-water system, which will transfer 275,000 gpm of water from and back to the river.

An efficient system, directed by Braun's field supervisor in charge of tools, has been introduced to keep track of air tools and maintain them in good operating condition. Stored in one central warehouse and in four unit warehouses in different parts of the working zone, most of them are issued from the latter depositories. When tools are in need of repair they are returned to the central warehouse and then sent to the Pneumatic Equipment Service Company in Philadelphia which uses only manufacturers' authorized parts. The service is quicker than that obtainable by returning them to the factory.

A power plant being engineered and built by Braun for the Delaware Power & Light Company has been assigned a 40-acre plot on the site and its construction is a separate operation from the refinery proper. Initially, it will contain two 25,000-kw turbogenerators, and room will be provided for a third unit. Steam will come from three boilers, each capable of producing 500,000 pounds per hour at 1300 psi pressure and 950°F temperature. Other facilities will include fuel- and ash-handling equipment, a water-treatment plant and electrical switchgear. The 500-foot powerhouse stack of concrete lined with brick will be the highest structure in Delaware.

None of the hubbub of construction will be in evidence when the huge, well-ordered plant goes into operation. For the most part, the multiple refining processes will be carried out quietly and few of the 500 or so employes will be seen.

From Gold to Wonder Metal

GUNNAR MINES

A Leading Canadian Source of Uranium

C. H. VIVIAN

CANADA is certain to be an important source of uranium ore in the dawning nuclear age. In addition to the 20-year-old crown-owned Eldorado Mine at Great Bear Lake, which was primarily a radium producer until World War II years, several recently discovered privately owned properties that are regarded as sure-fire large future producers are now either operating or soon will be. On the strength of disclosures of underground ore reserves indicated by diamond-drill probing, they have collectively been able thus far to negotiate contracts with their government calling for the delivery of ore or concentrate worth more than $700 million during the next few years. By 1960 the total is expected to be a billion dollars. Ore processing mills built or under construction have an aggregate capacity of 19,200 tons daily.

Two of the larger properties—Gunnar Mines Limited and Pronto Uranium Mines—went into production during the same week last fall and since then have been ironing kinks out of their milling plants, breaking in working forces and going through the various other labor pains necessary to stabilize operations. Although they yield the same end product, the two enterprises differ considerably.

Gunnar is situated in a sparsely settled area 300 miles from a railroad, whereas Pronto is near some sizable centers of population. For several years at least Gunnar will be an open-pit mine, but Pronto will go underground at once. Their ores and therefore their concentrating processes differ. Gunnar's ore is of higher grade than Pronto's, averaging around $38 per ton in uranium-oxide content as compared with probably $20. Because of its remote location Gunnar will face somewhat higher production costs. Initially, Pronto's ore output will be slightly larger, its mill being rated at 1500 tons per day as against 1250 tons for Gunnar's. However, the actual tonnage handled by such plants often considerably exceeds their ratings and cannot be determined definitely until they have been run for some time.

LOOKING AROUND

Despite the remoteness of the mine, many of Gunnar's invited guests attended the official opening last October 20, more than 50 flying in from Toronto. Here some of the visitors are clustered about two of the three heavy-duty Drillmasters that do the primary drilling of ore in the open pit.

Gunnar, to which the remainder of this article will be devoted, spent approximately $20 million and two years of strenuous effort in preparing for production. The company has an interesting background, and there is a distinct connecting thread between it and the Eldorado Mine. For one thing, Gilbert A. LaBine, one of Canada's best-known mining men, was in on the discovery and development of both properties. Furthermore, both companies were none-too-prosperous gold-mining enterprises before they turned to uranium. To establish the ties between them we will recount their histories briefly.

A story often printed gives part credit for LaBine's discovery of the Eldorado deposit in 1930 to a geological report made 30 years earlier. In 1900, J. McIntosh Bell, then 23 years old, accompanied Charles Camsell and three bushmen on a Geological Survey expedition to Great Bear Lake, which lies athwart the Arctic Circle in North West Territories. He noted that numerous stringers of calcite in the greenstones in the northwest (McTavish) arm of the lake contained chalcopyrite and that the steep shores were stained with cobalt bloom and copper.

LaBine, while praising the fine work of the Geological Survey in Canada, declares that the "so-called Bell-Camsell report had no influence whatsoever on my discoveries at Great Bear Lake." The events leading up to this find were outlined by LaBine in a letter he wrote on returning an earlier draft of this article that had been submitted to him for checking. LaBine relates that he started prospecting in northern Ontario in 1906 and participated in the Hollinger grubstake in October 1909. "I was one of the early fellows in that field, as well

SASKATCHEWAN PHOTOGRAPHIC SERVICE

GUNNAR PROPERTY

Aerial view of the $20-million development in the Beaverlodge area of northern Saskatchewan. The tanks at the upper-right store oil for the 6000-hp diesel-engine power plant. Below them and to the left are shops, warehouses and offices. In the center is the mill, and in the trees right of it are bunkhouses, cookery and other accommodations for the men. Site of the open pit is near the left end of the mill. In the background are the waters of St. Mary's Channel, Lake Athabaska.

LOCATION MAP

The Gunnar Mines property is located on McTavish Arm, which juts into Lake Athabaska from the north shore. It is about 300 water miles from the nearest railroad terminus at Waterways, Alta. Lake Athabaska is 195 miles long, from 20 to 40 miles wide, has an area of 3085 square miles and is approximately 690 feet above sea level.

as having previously covered the Elk Lake and Gowganda booms in 1907-08, along with my brother, Charles."

In 1926, LaBine and his brother Charles formed Eldorado Gold Mines Limited to work a gold property in Manitoba. The venture was not wholly successful, and when operations were discontinued in 1928 he persuaded his associates to let him search for other deposits. He was, of course, thinking of gold, silver, copper and lead. Having heard some older men in previous years speak of promising ore indications in North West Territories he determined to go there and, failing to get anyone to accompany him, went alone in 1929.

Leigh Brintnell, manager of Canadian Airways, flew LaBine in, covered some of the shore of Great Bear Lake so that he might get a glimpse of the entire area, then put him down on the east side to look at some huge quartz outcrops they had seen and proceeded to Dawson. Another flier, C. H. ("Punch") Dickins, picked LaBine up later for the return trip south. It was then that LaBine spotted the iron-stained hilltops that drew his attention to the section in which he subsequently located the Eldorado claims.

"I asked 'Punch' to circle the area," he wrote, "and while he was doing it, I sketched it into my field notes and told him I was coming back the following year to cover the area and to connect up the work I had done that year. In my survey of August 1929 I had found a great amount of copper, and in one section in particular I had found at least 2000 tons that had been taken off by the glaciers. Some pieces above the ground weighed as much as 200 tons and would average 50 percent copper. I had also found cobalt and bismuth farther to the east, and I had definitely made up my mind that someplace, somewhere in the area, silver and other minerals would be found. The structures

were ideal and it was just a matter of spending further time and getting better equipped for my next expedition.

"In the early winter of 1929 I went to Ottawa to see what I could find in the archives, and the only geological information that was available was the report of Bell's which indicated only that someplace, somewhere in the McTavish Arm he had noticed cobalt bloom and evidently copper carbonates, but no specific mention was made as to what part of McTavish Arm he referred. McTavish Arm covers about 500 to 600 miles of shoreline, so the information did not mean very much to someone who had already been in the field and had found deposits and mineralization such as I had found."

LaBine went back in 1930 in company with his brother Charles and E. C. St. Paul of Red Lake, Ont., whom he had engaged as an assistant. They flew to the Camsell River area south of Great Bear Lake in March and began working northward on foot in temperatures of 20 to 45° below zero Fahrenheit. They reached the locality they were seeking about May 15 and established camp. St. Paul became snow-blind, and LaBine alternated between caring for him and prospecting. While following outcroppings of cobalt and silver minerals, he came upon some pitchblende, an ore of radium and uranium. Fortunately he knew what it was, and further searching revealed a second vein.

That was the beginning of the Eldorado Mine which, under LaBine's guidance, became one of the world's foremost radium producers. The uranium in the ore was also recovered, but the market for it was limited and the surplus was stored around the Port Hope, Ont., refinery to which the concentrate was flown from the mine for treatment. That was the situation in 1943 when uranium, unknown to the public, became a much wanted metal for the atomic-bomb program. That year the Canadian Government took over Eldorado's assets and has operated the company since then. It issues no production figures. So much for Eldorado.

Gunnar Mines started out as Gunnar Gold Mines, Ltd. It was incorporated in 1933 in Ontario, with Gilbert LaBine as president and Charles LaBine as vice-president, to work fifteen gold claims in the Big Rice District of Manitoba. Between April 1936 and May 1942 it mined and milled 299,000 tons of ore, recovered $3,720,000 worth of gold and paid $647,000 in dividends. Then the ore played out, so the mill was sold and a search begun for new deposits. Under Gilbert LaBine's direction its prospectors looked over many showings in Manitoba but failed to uncover anything that was considered worth developing.

For some time following World War II the Canadian Government reserved uranium mining for itself, and its Eldorado company found and started to develop two new properties at Lake Athabaska that are now the Ace and Fay mines. Although some 600 or more miles south of Great Bear Lake, Athabaska is still 300 miles north of Waterways, the nearest railroad point. The Lake Athabaska area had been prospected for more than half a century and experienced several incipient booms during which hundreds of men swarmed over the terrain that is now yielding uranium.

J. B. Tyrell made a reconnaissance trip for the Geological Survey of Canada in 1893 and reported indications of iron ore along the north shore of the lake. Those deposits were staked and restaked from then on until the 1920's but were too lean to be of commercial value. Next, between 1914 and 1919, H. Dardier, backed by British capital, used a Calyx core drill in trying to prove up some nickel showings near Sucker Bay. The drill, 400 feet of 5½-inch core and some of the shot used for cutting were still there a few years ago. It is said that the Indians tried some of the manganese steel shot in their guns but found it bad for the barrels.

The discovery of copper and gold in 1934 sparked another rush, and the Box and Athona gold mines were opened up. The ventures became unprofitable when costs rose during the war years, and the finding of higher-grade deposits at Yellowknife in North West Territories just about depopulated the section. However, uranium minerals had been recognized in the Box and Nicholson mines and later led to additional work by Eldorado and the Geological Survey that resulted in the exploitation of the crown-owned Ace and Fay properties referred to a few paragraphs back.

In 1948 the Canadian Government lifted the ban on private uranium mining and the Province of Saskatchewan opened up a part of the area to prospecting on a concession basis. A rush ensued, and in 1951 more than fifteen diamond drills were in operation and five shafts were sunk. At the annual meeting of Gunnar Gold Mines on June 5, 1952, Gilbert LaBine announced that the company had started an exploration program in the Lake Athabaska region but gave no details.

On the twelfth of the following month two prospectors, Alfred O. Zeemel, representing Gunnar, and Walter Blair, acting for a syndicate that included some Gunnar stockholders, made the strike that is now the Gunnar Mine. On the following day they staked claims and began trenching. They couldn't accomplish much because of overburden, but noted that frost-heaved boulders in a swampy area recorded high instrument readings. When Gilbert LaBine received word about it in Toronto he flew in immediately. The first public information

SASKATCHEWAN PHOTOGRAPHIC SERVICE

CLEARING THE WAY

After surficial muskeg and silt were stripped from the open-pit site, rock overlying the ore body was removed and the surface leveled to permit establishing benches for mining. Three wagon drills and two Gyro-Flo compressors that supplied them with air are seen performing this preliminary work.

BEGINNING OF OPEN PIT

Shown here are three Ingersoll-Rand Drillmasters on crawler mountings at work on the first benches of the open pit that will eventually be 400 feet deep. The Drillmaster is a 17-ton, self-propelled, complete drilling unit with an enclosed cab that will keep the operator comfortable even in the extremely low Northland winter temperatures. A 600-cfm Gyro-Flo compressor on the rig supplies air for propulsion, drilling and operating a hoist to handle various lifting jobs. Two reversible air motors control the crawlers separately, permitting the machine to make short turns and to negotiate grades of up to 30 percent. Hydraulic leveling jacks keep the 38-foot tower vertical on uneven terrain, and a hydraulic wrench makes easy work of loosening and tightening drill rods and removing bits. Four-inch holes are drilled up to 60 feet deep with Carset bits. Mill and powerhouse buildings are in the background and a water storage tank is on the horizon. Production from the pit is currently running around 1300 tons daily.

regarding the discovery was his statement made before leaving and published in *The Northern Miner:* "Gunnar has something new that looks quite impressive." He returned with 35 samples of the radioactive boulders, and assays showed that they were unusually rich specimens of uranium.

Diamond drilling was immediately begun to determine the grade and extent of the ore. The results were so favorable that work continued throughout the following winter, with heaters in use to prevent freezing of the drills' water lines. The first holes were spaced 75 feet apart in a line running east and west; then others were drilled in a line extending north and south and crossing the first one in the middle. Single cores added several million dollars worth of ore to the total previously indicated.

The Gunnar discovery touched off a staking rush that reached its climax in the spring of 1953. Between late February and the end of April more than 6000 claims were located. Mining Recorder William McDonald set up an office in a tent and handled the paper work on 5000 claims in March alone. Meanwhile, a white frame building was being snaked 15 miles over winter roads from Goldfields to Uranium City, and he moved into it in the early summer. The northern shore of the lake was staked solidly for 50 miles, and some prospectors filed on the south shore. A number of diamond drills operated on the ice until the thaw came.

By June 1953 Gunnar had done enough sampling to indicate a deposit averaging at least $30 per ton and large enough to warrant opening a mine and building a concentrating mill. A capacity of 750 tons a day was discussed initially, but as further drilling disclosed more ore it was increased to 1250 tons in March 1954. It was then decided to initiate a construction program with September 1955 the operating target date.

Carrying out this schedule involved a huge amount of planning and work. All the machinery that would be needed for mining and milling had to be determined and ordered so that it could be procured in time for delivery during the relatively short summer season when the waterways are open. The mill and supply buildings had to be erected and the overburden stripped from the ore deposit in preparation for mining. First of all, accommodations had to be provided at the site for the workmen, and supplies sufficient to last until the following spring had to be brought in.

In anticipation of all this a process for treating the ore successfully had been developed so that the mill might be suitably designed and equipped. That was accomplished by blasting loose 100 tons of ore and shipping it by barge to Waterways and thence by train to Ottawa for metallurgical tests by the staff of the Bureau of Mines laboratory and A. H. Ross, Gunnar's metallurgist.

To receive barged freight Gunnar built a pier on the lake shore adjacent to its property. In 1953 some 3000 tons came by water. During the 1953-54 winter 457 tons of vitally needed things were flown in by RCAF planes that used a cleared strip on the ice-covered lake as a runway. In the summer of 1954 approximately 20,000 tons of freight arrived by water. The biggest item was 96 carloads of cement, but just about everything was included. In the same season Gunnar slashed an airstrip 5600 feet long and 600 feet wide out of the bush and graded it. A plane purchased at that time averaged three trips weekly to Edmonton until the construction period ended.

Water freighting reached its height in the summer of 1955 with the delivery of 30,000 tons. Bulking large were two million gallons of diesel fuel oil and 13,000 tons of sulphur. Local conditions are not favorable to the generation of hydroelectric energy, so all power is obtained from diesel-engine generators. The plant, with a capacity of 6000 hp

SASKATCHEWAN PHOTOGRAPHIC SERVICE

FROM THE LAKE SIDE

Overburden and waste rock from the pit were deposited to build up the area in the right-foreground. At the left-center is the pier where most of the materials for the structures shown were unloaded.

in four units, cost about $1,000,000. Sulphur is required for making sulphuric acid, which is essential in the leaching process by which the ore is concentrated. To insure a continuous supply, Gunnar contracted for 14,000 tons yearly. It will come from "sour" natural gas produced by Shell Oil Company at Jumping Pound, Alta.

The Gunnar ore body is in a complex of pre-Cambrian sedimentary rocks into which were intruded dikes and flows of granitic lavas. Folding and other movements at various times created faults and shear zones in which the mineral was deposited. Folding produced a trough that is known locally as the Gunnar Swamp, although much of the surrounding terrain is rugged, with hills rising 500 feet above the lake level. It is unusual to find pitchblende associated with granite and disseminated through the host rock. The ore has apparently replaced the mineral albite, a feldspar. The proportion of lead to uranium indicates that the deposit was formed approximately 645 million years ago, which puts it in the Proterozoic era, which is next to the oldest group of rocks.

The ore body outlined by 70,000 feet of diamond drilling is pipe-shaped, from 450 to 600 feet wide and of varying thickness. It is located on Crockingstone Peninsula, which juts into the lake about midway of the north shore. The deposit plunges southward under the lake at an angle of about 45° and its southern end is undetermined. Because it lies close to the surface, it can be worked as an open pit down to a depth of perhaps 400 feet, and it is estimated that $100 million worth of ore can be extracted in that way.

The pit has a surface area of 975x750 feet and will be mined by means of a series of benches 30 feet high and 20 feet wide. Beginning in April of 1954 around 190,000 cubic yards of overburden was stripped off, and that was followed by the removal of 900,000 tons of rock and ore in leveling the floor and establishing the levels of the first two benches. Up to 510 workmen were employed. In the course of these operations 90,000 tons of ore that occurred as stringers in the rock was recovered and stockpiled and later put through the mill.

Originally the pit area was covered with from 2 to 3 feet of muskeg underlain by from 20 to 60 feet of glacial silt resting on top of the rock. Most of the silt contained enough clay to make it sticky when wet and was difficult to cope with. It was cleared away by a Marion dragline loading into Euclid trucks that traveled on temporary roads surfaced with crushed stone.

When the job of leveling and bench-outlining was started the dragline was converted into a shovel. Wherever the lower section of a working face was composed of waste rock, flat holes were put in and blasted and the rock was removed along with what overburden remained; but where it was made up of ore, overburden was bulldozed over the top of the bench and the ore surface was thoroughly cleaned with hydraulic monitors. These were supplied with water at 220 psi pressure delivered through a 10-inch line by two Ingersoll-Rand centrifugal pumps of 800-gpm capacity and a larger booster unit. This was necessary because the silt, if not disposed of, would have complicated milling of the ore.

Drilling for leveling and benching was done with Canadian Ingersoll-Rand X-72 drifters on wagon mountings. They used 9-, 18-, and 27-foot lengths of 1¼-inch drill rod and 2-inch Carset (tungsten carbide-insert) bits. The hole-spacing pattern varied from 4x4 feet to 5x6 feet. Air was supplied by two Gyro-Flo portables of 600-cfm capacity.

In producing the ore, drilling is done from the benches with three Ingersoll-Rand crawler-mounted Drillmasters each of which carries a Gyro-Flo 600-cfm compressor to provide it with air. Drill steel is 2⅜ inches in diameter and bits are 4-inch Carsets. Records kept during a 3-month test period showed an average of 19.8 feet of hole per hour. Bits were sharpened after every 35 feet of drilling and had an average service life of 975 feet. Holes are drilled on a spacing pattern of approximately 8x8 feet in ore and 9x9 feet in rock.

Blasting is done with Forcite of 60 and 75 percent strength and Dygel of 75 percent strength in 3x16-inch cartridges and, where water conditions permit, with 65 percent ammonium powder in bags. Drill cuttings are used for stemming. Holes are connected with Primacord, and firing is done with individual short-delay caps. Around 3 tons of ore is broken per pound of explosive.

Broken material is loaded with Marion and Lorain shovels into nine Euclid trucks and hauled either to the mill or waste dump. Roads are 50 feet wide, surfaced with ¾-inch crushed stone and have a maximum grade of 8 percent. About 50 men are employed in the pit. During the winter months the drills were run 24 hours a day to guard against possible damage due to thickening of the lubricants. Other work was on a 2-shift basis. All equipment will operate two shifts during the summer months.

Although all ore will come from the pit for probably five years, sinking of a 3-compartment shaft has been started so as to allow adequate time in which to prepare for underground mining and to permit diamond-drill prospecting of the deposit where it pitches under the lake. For the present the shaft will reach to a depth of 1265 feet, and working stations will be cut at 150-foot intervals. A cage in counterbalance with a 9-ton skip will be operated by a Canadian Ingersoll-Rand double-drum hoist with a 400-hp motor.

Gunnar's mill has two sections, each with a rated capacity of 625 tons of ore daily but capable of handling more. After the ore has been crushed fine enough so that 60 percent of it will pass through a 200-mesh screen, sulphuric acid is added and the mixture is agitated

to put the uranium in solution. The uranium is then recovered from the liquor by precipitation with magnesia, followed by an ion-exchange process that has been utilized in South Africa. The dried product, a yellow powdered uranium oxide, is packed in steel drums weighing 450-500 pounds and flown to the Eldorado refinery at Port Hope, Ont.

The sulphuric acid used in milling the ore is made at the site at the rate of about 145 tons daily in a $1,000,000 plant based on a Monsanto Chemical Company method. By it sulphur is burned in pressurized air to form sulphur dioxide. The latter is then passed over a catalyst—vanadium pentoxide—to form sulphur trioxide, which is combined with water to produce the acid. Steel-tank storage for 3000 tons is available.

The heat developed in burning the sulphur will be utilized to provide up to 10,000 pounds of steam, as well as hot water needed in the mill. Some of the steam will operate pumps and a 20,000-cfm blower in the acid plant. In the wintertime it will heat the mine and mill buildings and perhaps some structures in the town. The latter, a $1,000,000 development, will eventually include accommodations for 700 people, stores, homes and a recreation center. Some unmarried workmen will live at the mine, where bunkhouses for 400 were erected during the construction period.

As agent for the Canadian Government, Eldorado Mining & Refining Company is the sole purchaser of uranium in the Dominion. The amount paid for it varies with the grade and the concentrate. To cite an example, it is $7.25 per pound of uranium-oxide content in concentrate grading at least 10 percent and obtained from ore containing less than 0.25 percent uranium oxide. However, the stated prices are subject to negotiation. As soon as Gunnar learned that its deposit was extensive, discussions were entered into and it contracted to deliver $79,950,000 worth of the oxide by October 1, 1960.

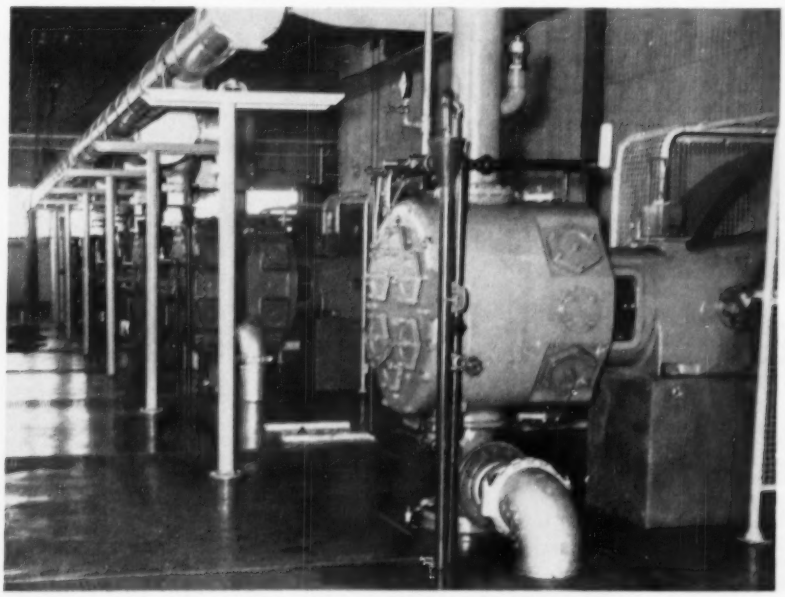
BENCHING STARTED

Another drilling scene that shows benches beginning to take form. Although ore will come from the pit for several years, sinking of a shaft for underground mining has been started.

The mill began to run at part capacity last August and was gradually broken in and brought up to total rating. Since then shipments of concentrate have been going out regularly. During March, the first month in which an attempt was made to operate at full capacity, the mill handled an average of 1300 tons of ore daily and produced concentrate containing $1,250,000 worth of uranium. Output was well ahead of the 800-ton daily figure on which the company based its calculations at the time it was arranging financing. It is expected that the current rate will be maintained until the end of the year when additions now being made to the mill will permit increasing the ore input to 1650 tons daily. It was also reported at the end of March that mining operations were proceeding satisfactorily and that the quantity of waste rock handled was steadily decreasing.

Funds for the initial development work were provided by the Gunnar treasury and by members of the syndicate that had an interest in the property. Later on a loan was negotiated with the Imperial Bank. When plans for the mine and mill had been well formulated and probable expenditures could be computed, a $19,500,000 bond issue was sold to a group of Canadian investment firms. At no time was capital obtained from outside of Canada.

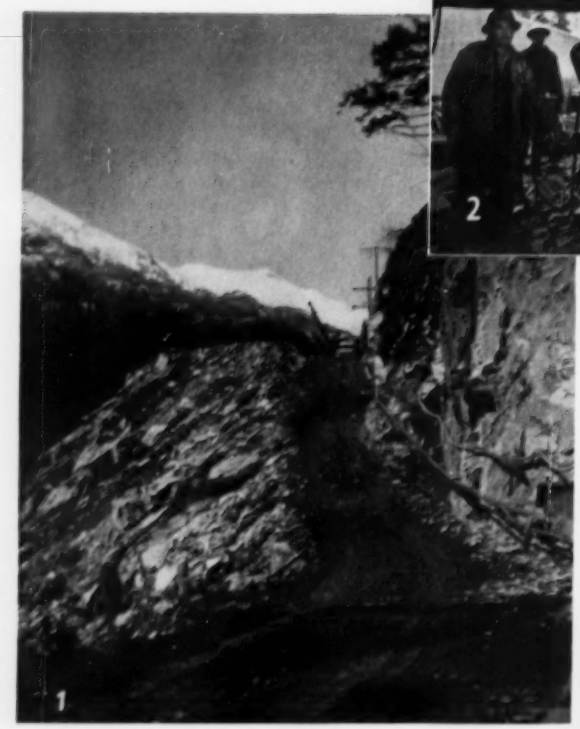
The cost of bringing the mine into production was kept within the estimate, and the plant was ready for operation as scheduled. The interest held by the syndicate was subsequently turned over to Gunnar in exchange for stock. Gunnar's prospector, Alfred O. Zeemel, was handsomely rewarded with 25,000 shares for his part in the discovery.

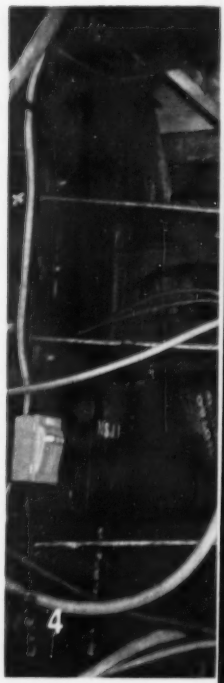


VACUUM PUMPS IN MILL

Five Canadian Ingersoll-Rand motor-driven dry vacuum pumps in service in the ore concentrating mill. Each unit has one cylinder of 31-inch diameter and 13-inch stroke. The same building also houses two I-R air compressors.

CANADIAN TUNNELERS CLAIM RECORD





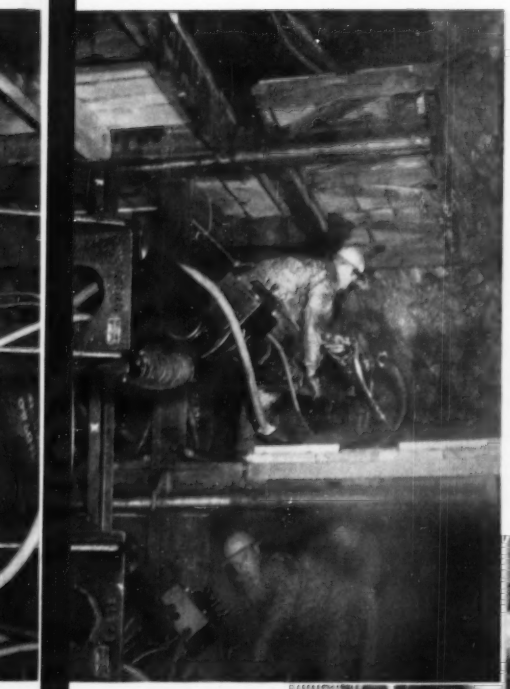
1 ROAD TO WEST PORTAL. Construction of access roads to the working sites in the high and rugged mountains was a big job. A steep stretch of one of them is shown with a Gyro-Flo portable compressor at the top of the rise.

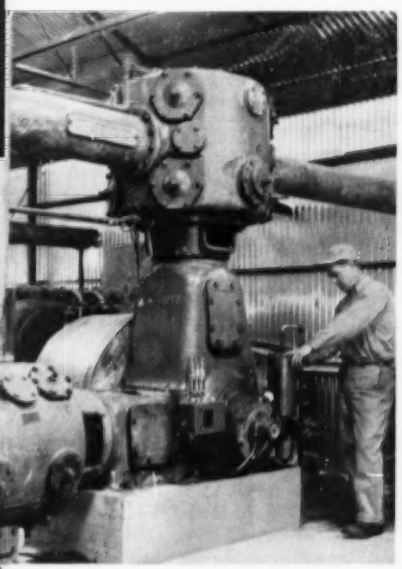
2 JUMBO AND CREW. Front end of drill carriage outside the east portal, with nine DB-35 drifters mounted on hydraulic booms. In the group standing on the ground, C.C. (Bill) Harris, general underground superintendent, is at the right. Next to him is Alf Ostgard, superintendent at the east portal.

3 COLLARING PORTAL. Carriage drilling first round at the west portal. A short pilot tunnel was first driven to test the rock, which here looks quite solid.

4 DRILLING CLOSE-UP. Action on two levels at the right side of a jumbo shows two drills at work.

5 AIR SOURCE. Three Canadian Ingersoll-Rand Type XVH compressors supply air for the drillers at each end. Pictured is one unit at the eastern end.





TUNNELERS working under Mt. Garibaldi in British Columbia, Canada, believe they have established a new progress record. Crews driving a 6.7-mile bore on the Cheakamus River Project 50 miles north of Vancouver have advanced one heading 397 feet in six days and 76 feet in a single day. Both marks are thought to be the best ever made in a tunnel of this size, which is 18x18 feet in cross section. Better marks have been made in smaller tunnels.

The Cheakamus River Project, which will cost around $25 million, is being carried out by the British Columbia Electric Company to provide more power for the southern section of the province, where the demand is growing at the rate of approximately 100,000 hp annually. It calls for damming the Cheakamus to collect water, diverting it through the tunnel to the valley of the Squamish River and there dropping it 1100 feet through penstocks to turn twin 95,000-hp turbines that will drive generators. The dam will be an earth-rock fill structure 2000 feet long at the crest and 90 feet high. From it, water will flow into Shadow Lake and thence into the tunnel.

A transmission line to Cheekye, 14 miles to the south, will tie the new plant into the company's existing distribution network. The station will be arranged for automatic operation, with control by carrier impulse from the load control office in Vancouver.

Mannix-Stolte, a combination of Mannix Ltd of Calgary, Alta., and Stolte International, Inc., of Oakland, Calif., has the contract for constructing both the tunnel and the powerhouse. Camps were established at each end of the tunnel to house the crews. The east camp is near a railroad, but an access road had to be built through rugged terrain to reach the west camp. It has grades up to 27 percent, and some heavy equipment was dragged over it on steel sleds. Electric power is provided at each portal by diesel generators, and compressors also are diesel driven. They are of the stationary type and three are installed at each end.

The bore, locally called the Squamish-Garibaldi, is being excavated from the downstream or western end as well as from an adit that was driven in from one side to intersect the tunnel line at a point 3500 feet from the site of the east portal. This scheme of attack was necessary because the intake will be under Shadow Lake. Mannix-Stolte will stop the advance when within 65 feet of the upper end. Later the lake will be drawn down so that the portal can be opened. This work will be done under a separate contract.

In service at each end is a drill carriage mounting from nine to eleven Canadian Ingersoll-Rand DB-35 drifter drills on individual hydraulic booms. Carset (tungsten carbide-insert) bits 2 inches in diameter are used with 1¼-inch hollow, round drill rods. A typical round consists of 70 holes averaging 11 feet deep. Blasted material is loaded into Granby-type cars by Conway mucking machines and hauled out by storage-battery locomotives. Ventilating air is piped into the workings from an Ingersoll-Rand 15,250-cfm blower at each portal.

The greatest footage is being made at the western heading, which has been in sound, medium-hard rock most of the time. At the eastern end a drill carriage started driving from the inner end of the adit toward the upstream portal, while a smaller crew without a carriage began working in the opposite direction. Bad ground was encountered there and operations proceeded with caution on a one-shift daily basis. The geologists indicated that sound rock would be reached about 500 feet away from the adit. The carriage will be shifted to that heading as soon as it finishes excavating the 3500 feet to Shadow Lake.

Uniformly good progress has been made by the carriages since last February. Crews advanced the western heading 310 feet in one week and began to get record-conscious. During the next few weeks they repeatedly bettered their previous performance by chalking up 355 feet, then 373 and finally 397. It is now expected that tunneling will be completed by next November, two months ahead of schedule.

C. P. Baker is project manager for the contractor, C. C. ("Bill") Harris is general underground superintendent and J. Reimer and A. Ostgard are superintendents at the western and eastern headings, respectively.

COLLECTORS SERVING WAGON DRILLS

Four of five Ingersoll-Rand wagon drills on the roadbuilding project shown were running when this picture was taken. No dust is visible, however, because it was being drawn into the two collectors in the right-center. These Foundation Equipment Company units use 2-stage separation—a cyclone and a bag filter—to trap dust. Each collector can serve two wagon drills.

Trapping Drill Dust

Capturing rock-drill cuttings safeguards health of workers and probably also improves drilling efficiency

R. J. Nemmers

DUST, as was noted previously in this magazine,* can be a rough customer. It plays havoc with machines if allowed to get into the wrong places and, under certain conditions, can be a menace to our well-being. Many adequate ways of preventing dust from interfering with us were pointed out in the earlier article, but most of them primarily concerned its removal from the atmosphere. Numerous tests have shown that it is sometimes easier and economically justifiable to attempt to trap and collect certain dusts before they become air-borne.

Now we will discuss what is being done to keep the air around us free of dust resulting from rock-drilling operations. A rock drill is essentially a crusher. The bit, whether tungsten-carbide tipped or of steel, shatters a large or small amount of rock, depending on conditions, each time it strikes a blow. Some of the cuttings may measure ¼ inch or more through the largest cross section; others are microscopic. If a drill is to function efficiently, some means must be furnished to carry away rock particles from the face of the hole. Otherwise they would soon be reduced to a fine powder and the force of the blows delivered by the drill would be cushioned by a thick layer of dust at the bottom of the hole.

In 1897 when J. George Leyner introduced hollow steel for use with his hammer drill he solved the latter problem. Thereby he made it possible easily to introduce a stream of water or jet of air into the hole to flush away rock chips. With air, the cuttings are forced to the mouth of the hole and discharged into the atmosphere. The larger, heavier pieces immediately drop to the ground, but the smaller ones form a cloud of dust which, in the case of aboveground drilling and if wind conditions are right, might be carried to the intake lines of compressors and engines or into the vital parts of other equipment. In addition, dust obscures an operator's vision and also may be a health hazard. Underground it is even more of a problem and must be disposed of by the mine ventilation system.

Filters are installed on intake lines to protect compressors and engines. But even so, the fine coating of dust which settles in the immediate neighborhood of a drill and the all-pervading air-borne particles can be more than a nuisance to all concerned. At this point someone may ask why air is used for hole cleaning, or why water isn't used all the time. Several reasons may be cited: among them the fact that water doesn't really stop all dust from spreading; lack of water in arid parts of the world; freezing weather in other areas; and also because air blowing is much more efficient in many cases especially in long, deep holes. Furthermore, water disposal may present difficulties.

The power consumed by a drill under any given set of conditions is roughly proportional to the area of new rock surface exposed with each blow. This is true regardless of whether the surface is presented by the drilling face itself or by a chip that has been reduced in size. It follows, therefore, that the larger the chips broken from the face and carried

SIZE OF CUTTINGS

Cuttings around the collar of a large-diameter blasthole on a coal-stripping operation in Alabama. The size of the particles can be appreciated by comparing them with the cigarette package. Coarse material like this would quickly fall out of the air issuing from the hole even if no collector were used. The finer, lighter particles are more annoying and troublesome.

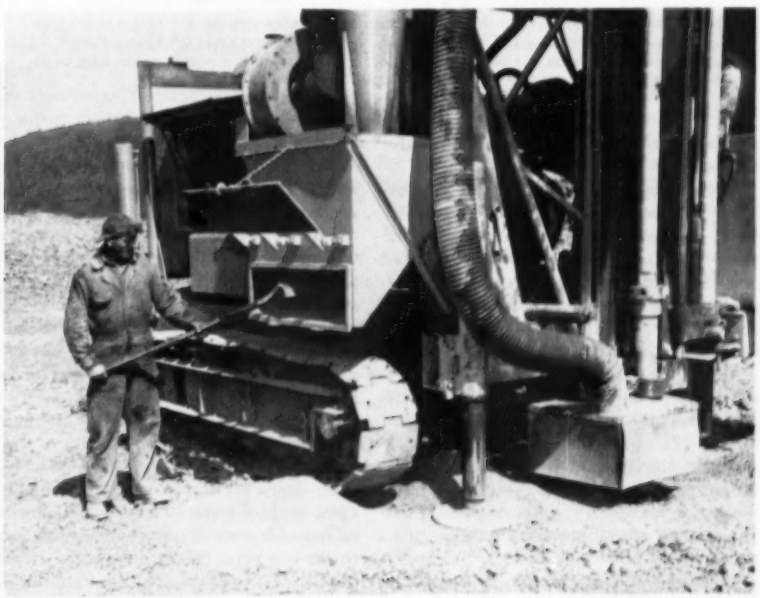
*Protecting Men and Machines from Dust, September-October 1954

away without further reduction, the greater the power efficiency. By using Carbide (tungsten carbide-insert) bits where necessary, keeping them well sharpened, and properly maintaining drills and steel, power costs can be lowered because larger chips will be cut with each blow and needless energy will not be expended in grinding the rock to a fine powder. The amount of dust created around a rock-drilling operation can be lessened simply by following the good practices recommended by manufacturers and will lead to more efficient use of men and machines as well. Nevertheless, some dust is an end product of all rock drilling and will continue to be so until someone discovers an entirely new principle that will make it possible to replace the 75-year-old key to the earth's treasures.

Dust can be captured, however, at the mouth of the hole by means of one of a number of efficient collectors and, though still produced, prevented from becoming air-borne. Most of these facilities operate in much the same way. Each has four basic parts: a hood which fits around the drill steel and over the hole; a chamber in which the air and dust are separated and the latter accumulates; a large-diameter hose through which the dust is relayed from the hood to the separator; and a means of pulling a vacuum on the system so that the dust will be drawn into the chamber. Supplementary holding equipment of the airleg type is required to position the hood against a vertical surface or the roof when drifting or stoping.

In service, vacuum is induced in the separator chamber and the dust-laden air emerging from the drill hole is drawn into a filter. But it should be noted that it is still necessary to blow air into the hole to remove the chips. No suction device can withdraw more air from a hole than is forced into it. Although the seal between the collector hood and the ground immediately around the hole is not tight, there is no dispersal of dust because of the pressure differential—incoming air effectually blocks the escape of dust from the hood. Some early attempts to design a collector were unsuccessful because it was thought that the pressure of the air coming out of the drill hole would be sufficient to carry the cuttings to the separator. Theoretically that would work, but in practice it did not because an air-and-dust-tight seal could not be maintained at the hood.

Present-day hoods are of two designs: one is in the form of a "U" and can be slid into place around the drill steel; the other is an O-shaped device through which the rod is inserted. Both have flexible-rubber and fabric flaps at various points to keep out excessive quantities of outside air, thus permitting the use of a vacuum pump of reduced capacity and saving power. Hoses are flexible and of the wire-wound type with a reasonably smooth interior to prevent the pile-up of dust and capable of withstanding the compressive force exerted



CARRIES OWN COLLECTOR

Some of the new, large, self-contained drilling units have built-in dust collectors. These pictures show an Ingersoll-Rand Drillmaster putting in large-diameter blastholes on a highway excavation job. The close-up above shows the hood at the collar of the hole, with its connecting large-diameter hose to convey cuttings to the collector. In this equipment, manufactured by the Aerotec Corporation, a centrifugal exhauster powered by a hydraulic motor provides the suction. The collector is of the cyclone tube type, and provision is made to inject water into the hole when greater efficiency is desired. The dust ends up in a hopper, shown open for cleaning, which is required about every four hours.

SOMETHING OLD, SOMETHING NEW

Many contractors convert old tractors into ultramodern mobile drilling machines. This one is self-contained. Out in front on Hydra-Booms are two I-R heavy-duty X-71 drifter drills. Across the back is a Gyro-Flo 600-cfm rotary compressor, and overhanging the track on the left side is a dust collector.

on the exterior because of the pressure differential.

Each collector commonly uses two or more methods of separation: one to remove the heavier chips and the others to extract the remaining microscopic particles. The former is called first-stage or primary separation and works about the same in nearly all models. As the dust-laden air enters the separator its velocity is reduced and its direction abruptly changed. The heavier cuttings—about 96 percent by weight—are thus precipitated. (They are the ones that normally drop to the ground immediately upon emerging from the hole.) The next stages or secondary separation may be effected by a number of different units, depending upon the efficiency desired.

Several of the better-known collectors have a cyclone separator. When that is the case it sometimes acts as a primary as well as a secondary separator. The device tangentially directs the air into an inverted cone, thus causing it to whirl. As the air approaches the narrow end of the cone its velocity naturally increases and the centrifugal force created throws the dust particles against the walls, where they drop out of suspension. The air stream then escapes to atmosphere—the exhaust stack generally being one of the highest points in the machine so that any dust remaining in the air will be widely scattered.

The cyclone separator alone will deliver air that is sufficiently dust free for many operations, but when a greater degree of efficiency is required it is necessary to resort to a bag-type filter or to water injection. The former functions just like any other filtering device—the air passes through the bag material while the dust particles are caught and held in the interstices. The water-injection system incorporated in some cyclone separators atomizes between 2 and 10 gallons of water per hour in the drill hole, depending on its size. Adsorption of a film of water on the surface of the fine particles makes them heavy enough to be precipitated in a separator, and some agglomeration also takes place.

Arrangements for emptying collectors vary from a simple trap-door mechanism in the hopper of a cyclone separator to more or less elaborate shaker devices in the bag type. Most have hoppers that do not need emptying oftener than twice a shift; that is, every four hours. The cuttings make excellent stemming for blastholes, and most contractors and quarrymen use them for that purpose.

Vacuum is drawn by any one of three units: an axial-flow fan, a centrifugal blower, or an air ejector. The two first-named are driven either by a gasoline engine or an electric, hydraulic or air motor. The air ejector, like a steam-jet ejector, works by establishing a pressure differential across a venturi. Regardless of the type, the vacuum pump is positioned downstream from the separator; dust does not go through it.

There are portable, semiportable or stationary collectors, but the majority of them are mounted on wheels. Most of them are rated to serve several drills at a time, much like portable compressors. Skid-mounted units are often seen in quarries where a great deal of drilling is concentrated within a relatively confined space. Sometimes a collector is an integral part of a self-contained drilling unit, as is the case with the Drillmaster illustrated.

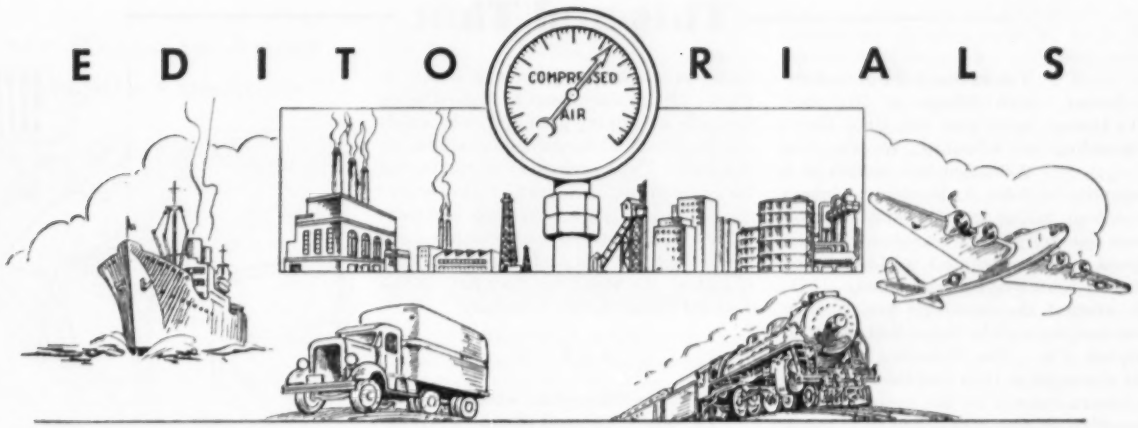
The economics of collecting dust at the rock drill have as yet not been fully determined. Contractors and quarry operators in areas where devices for the purpose are not required by law are understandably reluctant to add to already high costs unless it can be demonstrated that the expense involved will actually save them money. Research has indicated that drilling speed is increased markedly because of the cleaner holes obtained by the use of an exhaust-type collector.

In the case of one series of tests, for example, it was shown that dry drilling is 8 to 10 percent quicker than wet drilling, and that holes put down by dry drilling with a collector in operation can sometimes be bottomed even 20 to 25 percent faster. It remains to be seen whether those operators who have elected to utilize collectors will obtain results as favorable as those cited. Also, it may be that some employers will find the efficiency of workers improved to such an extent by getting rid of the dust nuisance that that factor alone will make it possible to amortize the cost of collectors over a reasonable period. That has been the case in numerous other industries.

KADCO COLLECTOR

The first dust collector to be applied to rock drills was the Kadco, which was developed in New York City when the foundations for the buildings of Radio City were excavated more than twenty years ago. Here dust drawn into a modern Kadco unit is being sacked for disposal. Large particles make excellent stemming for drill holes and are often used for that purpose by contractors and quarrymen.

EDITORIALS



A VOICE FROM THE NORTH

AFTER our article on Gunnar Mines (page 168) had been made up, we received a copy of the weekly newspaper from Uranium City, self-designated "uranium capital" of Canada. Located on the northern shore of Lake Athabaska, a few miles from the Gunnar property, the town is the "metropolis" of the new boom area and the shopping and recreational center for a great expanse of territory. It was built along model lines by the provincial government of Saskatchewan.

The paper, called The *Uranium Era*, is almost as old as the section's claim-staking rush, the April 20 issue that came into our hands being Number 13, Volume 3. Consisting of four 8½x14-inch sheets mimeographed on both sides, it is "edited, printed and published" by John Murray McMeekan, and the subscription rate is $5, local; $8, outside.

The *Era* affords interesting insights into the life and thinking of the people in this remote setting. Take that notation "outside" just referred to, for instance. To most of us, Uranium City would seem to be on the "outside," situated as it is 300 miles from the nearest railway. However, to its residents and those in the environs it is the focal point of everything they hold important.

No highways connect Uranium City with the "outside" world, so motor traffic isn't bothersome, but the community has its own unique transportation problem. The paper reported that during the previous week two trucks had plunged through the ice on Lake Athabaska. Their occupants fortunately escaped, but in one case the vehicle hit bottom in 20 feet of water before the driver managed to open the cab door and swim to the surface.

An editorial on the fishing season furnishes evidence that interest in angling knows no geographical bounds, but the lament of the editor would sound strange in more congested areas. He unburdened himself of what he called his "annual bee!" against compelling people up there to buy licenses in order to fish. That regulation, he contends, is foolish in view of the abundance of fish. In New Jersey, where anglers actually wait at the trout hatchery and then follow the stocking trucks to the streams for some "sport," the following description of conditions in the far North from Editor McMeekan's pen may be hard to believe:

"There is hardly a lake, stream, pond or pothole in this vast Northland," he wrote, "that does not teem with fish. Ninety-nine point nine percent of them are never visited by men from one year's end to another. Fishing is a moral, healthful and relaxing sport. If the population were multiplied by a thousand fold little impression would be made on the shoaling millions of fish . . . so why bother about licenses?"

Outstanding among all the editor's musings, however, is a sermon on clean, or rather unclean, literature. Time was when a mining camp—especially a new one—was supposed to typify the raw, primeval side of life with the worst instincts of men on the surface. In the old melodramas and, more recently, in scores of Hollywood films, the forces of right and virtue always had a tough time ousting the devil's minions and getting the town's officials to clamp down on the dens of vice and iniquity.

Evidently the New North and the Old West are as far apart in some respects as the poles. Uranium City has none of Tombstone's "man-for-breakfast" type of outlawry. All the *Era* can find to complain about in this department is the character of the cover art and contents of the periodicals, mostly American, coming into the camp. He objects not only to the cover displays of feminine anatomy but also to the rash of scenes portraying men being attacked and vanquished by everything in the animal kingdom from lions and tigers to piranha fish and snapping turtles. He voices a fear that someday a magazine will come out decked in a cover showing a prospector being eaten alive by chipmunks.

We don't mean to infer by all this that Uranium City isn't touched by human frailties. We noticed, for instance, that Alcoholics Anonymous offers, in an advertisement, to give its help when needed. We also saw two items about churches. Over-all, the *Era* is stimulating reading. It is good to know that the boom-camp type of journalism fostered by such notables as Bret Harte and Mark Twain still flourishes and that editorial thinking is as wide open as the spaces.

PUBLIC ENEMY NO. 1

THE common cold is undoubtedly our greatest killer—killer of time, that is. Nobody knows how much it costs industry through absenteeism. The Common Cold Foundation, which hopes to determine the cause of colds, says the annual toll is around five billion dollars. But this doesn't take into account the lowered efficiency of workers who stay on the job when suffering from colds. Ironically, the Foundation has some trouble each year raising its budget of $500,000, even though that sum is only one ten-thousandth of the cold's estimated financial drain on employers.

Some, though admittedly little, progress has been made towards ferreting out the cause of colds. One of the difficulties is finding capable medical men who are content to spend their time working on the problem. Nobody likes to tackle an adversary that is considered practically unbeatable, and the common cold has, with good reason, been termed "medicine's most baffling mystery."

Because the malady does slow down industry's pace, large concerns have been asked to be liberal in supporting the Foundation's efforts. A study made by Dr. Melvin N. Newquist, medical director of The Texas Company, reveals that colds are responsible for approximately one-sixth of the benefits paid for sickness of employes by our larger firms. Actually, it was found to average more than $17 per capita per year among 40,000 employes studied. In view of these figures it is argued that industry should class any payment to the Foundation as an investment rather than a gift.

This and That

Bridge To Honor Roebling

The nation's oldest suspension bridge, a 1010-foot span over the Ohio River at Wheeling, W. Va., was dedicated last month as a memorial to John A. Roebling, pioneer American bridge builder, and to engineers generally. The structure was designed and constructed in 1846-48 by Charles Ellet who had previously (1841-42) erected the country's first suspension span across the Schuylkill in Philadelphia, Pa. The Wheeling structure was damaged in 1854 and Roebling, who is known mainly as the builder of the Brooklyn Bridge, was called in to repair and strengthen it. He completed the job in 1856, an even hundred years ago.

Dr. D. B. Steinman, one of the foremost living bridge engineers, was the principal speaker at the ceremonies. He was raised within sight of the Brooklyn Bridge, and that influenced him to become a bridge designer. He has always been an ardent student of Roebling's work and is an authority on his life. Even now he maintains his office in the Roebling Building at 117 Liberty Street, New York, in the shadow of the Brooklyn Bridge. Steinman is presently engaged on the world's largest project of this kind, the building of the $99,800,000 Mackinac Bridge in Michigan.

* * *

Hardwood Used in Paperboard

The new $16-million paperboard mill of the Crossett Company in Arkansas combines pulp from hard- and softwood to make paper for milk cartons and drinking cups. The first of its kind, the plant has a daily capacity of 150 tons. The process promises to open up new markets for hardwood pulp, which has heretofore been used sparingly.

Crossett's research staff began the work on which the process is based in 1944. The problem was to find suitable methods of pulping gum and oak, which are the principal hardwoods available to the mill. Experiments were conducted for eight years, during which time varying mixtures of pulp from hard- and softwoods were converted into paper on a small machine. The paperboard was later tested at the Reading, Pa., mill of the Federal Paper Board Company.

"I want ya to volunteer for a dangerous mission . . . here, hold this bullpoint for me!"

* * *

TV Sets Are Night Watchmen

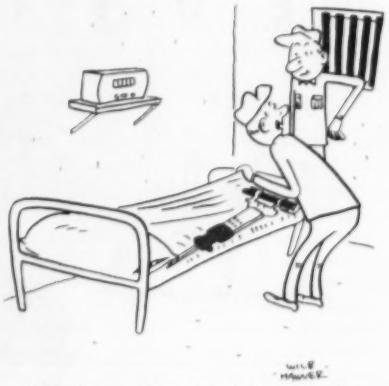
Tangible evidence that General Motors Corporation recalls the disastrous fire that destroyed its hydramatic automatic-transmission factory at Livonia, Mich., a few years ago is found in the precautions being taken to prevent such an occurrence at the Cadillac tank plant in Cleveland, Ohio. Night and day two television cameras perched on a tower swing in a wide arc to cover the factory's 29-acre roof. Although intended primarily to detect fire, they would spot anything else unusual up there—a prowler, even a cat.

Below, in one of the offices, guards view screens to see that all is well. Should anything strange appear, pressure on a button would instantly stop the movement of the camera covering it, and twirling a dial would bring the object up close for identification. By pressing another button the cameras can be brought under manual control and swung around for a quick inspection of the parking lots behind the plant and the area in front of the administration building. By means of a third button the guard would sound an alarm and, with a telephone at his elbow, could call any part of the building. The TV setup was manufactured and installed by Diamond Power Specialty Corporation. It is reported that industry is buying more than 100 closed-circuit units a month, or more than ten times as many as a year ago.

* * *

Something New Is Added

The idea of keeping log ponds open in cold weather by bubbling compressed air up through the water is now put to use in most countries that experience severe winters. In Sweden, however, it is also practiced in reverse. Where there is little ice, the air technique is applied to bring relatively warm water up from the bottom to keep the surface water in motion. Where the ice is fairly thick it is made thicker so that logs can be hauled over it. This is done by overflowing it with water brought up from underneath by a combination machine including an ice borer and a pump.



"Oh, it wasn't so hard, but sneaking in the compressor will be a bit more difficult."

* * *

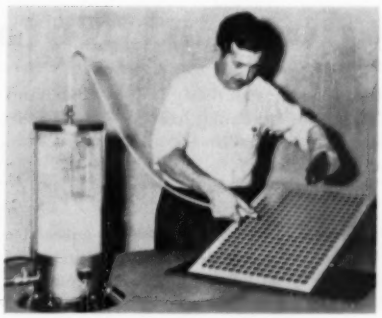
Needle in Haystack Outdone

An unusual salvage operation was the recovery of fragments of an exploded Navy jet from a 70,000-square-foot section of ocean bottom off California. The plane crashed into the sea at supersonic speed while on its test flight and the pieces were wanted so experts could diagnose the cause of its trouble.

George Smith, a pilot who gave up his regular day off to test-fly the jet fighter was 7 miles in the air when the plane nosed over and the controls froze. He shut off the power, rode the jet until it broke through the clouds at 6500 feet altitude and then used an automatic device to eject himself. The craft was traveling 777 miles an hour, and Smith was knocked unconscious by the tremendous shock to which his body was subjected when his parachute opened. Fortunately, he fell near a fishing boat and was rescued and nursed back to health.

The USS *Gear*, a salvage vessel operated for the Navy by Merritt-Chapman & Scott Corporation, was assigned to the job. It took two weeks to locate the spot where the plane crashed, and then combing of the bottom was begun. Divers working in 138 feet of water sent up basketfuls of small pieces—there were no large ones. To recover what they missed, a TV camera was rigged up on a sled to view the bottom, and as it was dragged along officers aboard the *Gear* watched the 30x30-inch picture it transmitted to a screen. A suction sweeper and an oversize oyster rake, that dug into the mud before its jaws snapped shut, completed the harvest. In all, 44 barrels of material, representing 89.5 percent of the jet's deadweight, were salvaged.

Air Helps to Apply Plastic Coatings



TWO COATING METHODS

Small preheated objects are allowed to remain for a few seconds in the bed of powder (left) that is fluidized by introducing air at the bottom of the container. Objects too large to be immersed are spray coated, as shown above. The air pressure is about 10 psi.

THE American Agile Corporation has developed what it calls a fluidized process for applying resistant coatings of polyethylene, polyfluorocarbons, nylon and other plastics to metallic and dissimilar plastic molded objects. The coating material is in powder form and is placed in a fluidizer into which compressed air is introduced to keep the powder in a dense, dry turbulent state.

After being preheated in a standard oven or by means of a flame, an article to be covered is normally immersed in the fluidized powder bed for a few seconds. That, it is claimed, will deposit a uniform coat up to 3/16-inch thick on even the most intricate shapes. When the part is removed from the bed, the residual heat is usually sufficient to melt and level the adhering particles to a smooth, tough, nonporous resin cladding.

The fluidizer can be equipped with a spray unit that fits on top of it for use where the object to be coated is too big to enter the chamber, or where certain interior surfaces prohibit maximum benefits from immersion. The powder then flows through a flexible hose to a nozzle that creates an effective spray pattern. The size of the article to be coated is limited only by the preheating facilities.

The new application equipment is reported to be as much as 50 percent faster than conventional spraying units working on the vacuum principle.

Circle 1E on reply card

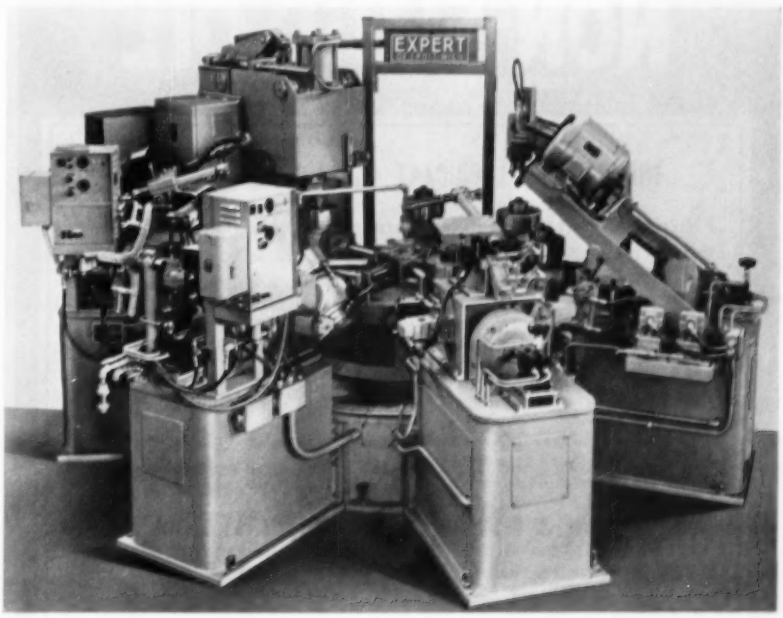
Rotary Index Machine Features Special Fixture

BY means of an unusual type of automated index machine designed and built by Expert Welding Machine Company it is possible, it is claimed, to clamp, press together, preheat, weld, remove spatter, and then unload gear and hub assemblies at the rate of 260 an hour. There are six stations grouped around a motor-driven rotary table with a clutch and cam index mechanism.

The parts to be assembled consist of a 5-inch-diameter gear of hardened steel and of a prewelded stamped steel flange and a machined hub. They are loaded by hand into air-powered clamping fixtures which are tilted by cams during the operating cycle and are the distinctive feature of the machine. Of two parts, each has an integral pneumatic collet chuck provided with a control valve that travels with the fixture and is actuated at Station 2 by an auxiliary pneumatic cylinder. When the fixture enters the unloading station the valves are released.

At the starting point, with the workpieces in place, the fixture is in the vertical position and is so indexed to Station 2. There the assemblies are simultaneously pressed together and preheated to 500°F by an induction coil in the head of a counterbalanced hydraulic press. As the part is carried to the third station the fixture is inclined 45° and a flanged head moves forward to engage four radial rollers with the face of the fixture to lock it firmly for welding. This involves making three argon-shielded arc, running spot welds at 120° points at Station 3 and similar welds spaced accurately between the first ones at Station 4. By the time the fixture reaches the next station for spatter removal it is again in a vertical plane and remains so throughout the cycle. The wire brush used for the purpose is lowered and raised by an air cylinder, the assembly being rotated during both the cleaning and welding operations. Finally, a mechanical hand powered by a pneumatic cylinder unloads the finished work.

Circle 2E on reply card

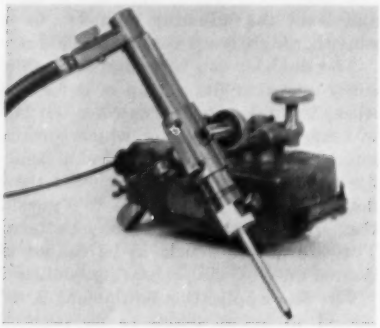


PERFORMS MULTIPLE FUNCTIONS

This rotary index machine is 11 feet in circumference and 8 feet high. It is operated by two push buttons, but manual controls are provided to permit independent operation of each of its six stations. Designed to produce welded gear and hub assemblies, it features air-powered clamping fixtures that are tilted during the automatic working cycle.

Industrial Notes

Previously made only in hand-held models, an Arcair Torch that needs no human guidance has been developed by Arcair Company. The new tool is firmly held in a fixture and moved mechanically along a track for long uncomplicated cuts, gouges, bevels or grooves in metals or, as in the case of circumferential



seams, the fixture is stationary and the work is rotated. Speed of travel is adjustable. The only variable remaining is feeding the electrode, which still requires the attention of the operator. This is done by racking the cylindrical tube which grips it. Two models are available: the L-3 and the L-5 which take electrodes up to 3/8- and 5/8-inch diameter, respectively. Like the hand type, the traveling torches depend on an electric arc and compressed air to do their work.

Circle 3E on reply card

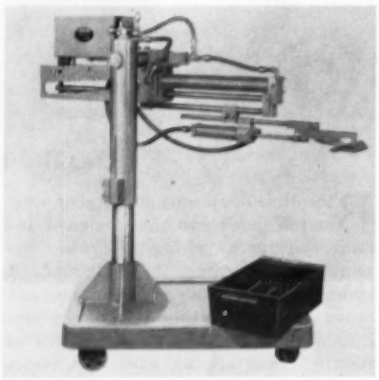
Sterile, lint- and dust-free gases are obtainable, it is claimed, by means of a filter that combines cotton packing with a porous stainless-steel filter element. The former removes microörganisms from a gas, while the latter prevents contamination of the stream by lint fibers. The separators are fabricated of 18-8 stainless steel and designed for in-line mounting in a piping system. They can be packed with the cotton, sealed and sterilized as a unit for pharmaceutical operations such as the sterilization of compressed gases used to transfer sterile liquids from reactor vessels, work that cannot be done by mechanical pumping. The units can be made to handle large or small gas flows at low pressure differentials. They are a product of Micro Metallic Corporation.

Circle 4E on reply card

Heavy-Duty Grip is now being offered by The Hallemite Manufacturing Company in brilliant aluminum to increase the visibility of stairways, corridors, interiors of truck bodies and other dimly lit areas while serving its primary purpose of making floors slip-proof. Sandpaperlike in texture, it is said to wear like iron and to be immune to water, gasoline, oil, grease or solvents. Ready-mixed, the material is applied by trowel and sticks to metal, wood and concrete.

Circle 5E on reply card

Primarily with the automation of the job shop in mind, Sahlin Engineering Company, Inc., has redesigned its portable press unloader for light work. Known as the Series 3000 Iron Hand, it is equipped with the same air cylinder, controls and jaw as the standard overhead model for large stampings. Rolled up to a press, it is adjusted for die height and swiveled for side or back unloading.



Jaw movement is in a straight line. After the ram has completed its downstroke, the hand moves into the die and grips the work; when it has sufficient clearance it lifts the stamping, travels back, drops it into a tote box and returns to its original position ready for the next press cycle. A variety of jaws are available to handle special materials and shapes.

Circle 6E on reply card

Liquid zinc that can be applied by brush or air spray has been put on the market under the name of Zinc Shield by Wilbur & Williams Company. It can be used as a primer or to restore galvanized surfaces after they have been cleaned. The film is said to dry in about 30 minutes and can be overcoated in about four hours.

Circle 7E on reply card

For use in or near hazardous areas, Davis Instruments, Division of Davis Emergency Equipment Company, Inc., has developed an explosionproof analyzer and alarm system for combustible gases. Portable and self-contained, it is a continuous sampling unit operated by a motor-driven pump mounted inside the housing. Advantages claimed for the in-

NON-FLUID OIL
TRADE MARK REGISTERED

THE PERFECT LUBRICANT FOR PNEUMATIC TOOLS

No matter what temperatures or atmospheric conditions your pneumatic tools are subjected to, they will continue to function efficiently if "NR" grades of NON-FLUID OIL are used exclusively.

This superior lubricant gives complete rust protection by emulsifying with airborne moisture. . .without losing any of its lubricity. It's affinity for metal surfaces prevents fogging and blow-out losses. . .even in the lighter grades with a pour point of −30°F.

Try NON-FLUID OIL for yourself, and you will see what we mean. Free samples, together with Bulletin 550, will be sent on request.

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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

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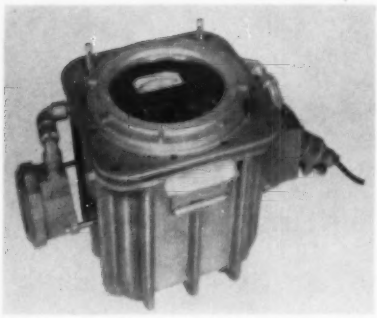


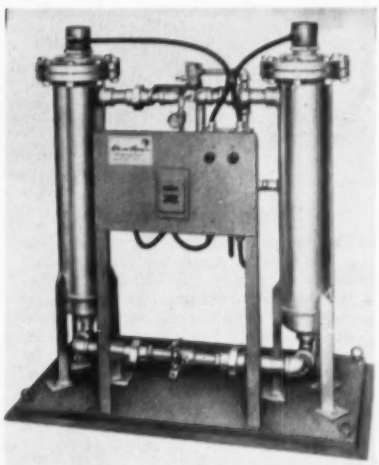
strument are: visual and audible "high-gas" signals; a large meter calibrated from 0 to lower explosive limit and showing gas or vapor concentration at all times; and a built-in trouble-indicating circuit with both a warning light and audible alarm.

Circle 8E on reply card

By means of a device now being tested at Battelle Memorial Institute of The Ohio State University, Columbus, Ohio, night driving may be made safer because it promises to protect the eyes of motorists from the glare of approaching headlights. To be generally effective all cars would, of course, have to be equipped with the instrument, which is essentially an electric eye and calls for the use of an ellipsoidal instead of a parabolic reflector. When the beam from an oncoming automobile strikes the photoelectric cell, it causes a vane to cover a part of the headlight, the extent of the coverage depending on the direction of the beam. In other words, the shadow cone changes as the two cars change position, thus effectually cutting out the disconcerting glare without interfering with the functioning of the headlight.

For dehydrating compressed air and other gases to a dew point of minus 50°F or lower, Kahn & Company has announced a new type of drier that is designed for continuous service. The unit has twin adsorption towers through which the stream passes alternately and automatically, one dehydrating the gas while the adsorbent material in the other is being reactivated. Six standard models are available for different flow requirements and operating conditions in laboratories and varying industrial plants.

Circle 9E on reply card



Liquid storage tanks as well as other structural or machine components up to 18x36x96 inches in size are being formed of reinforced plastic by a new molding process. Made by Structural Fibers Inc., the products are resistant to corrosive attack by water, mild acids and alkalies and are said to have up to 30,000 psi flexural and 18,000 psi tensile strength.

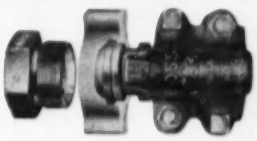
Circle 10E on reply card

For simultaneously burring and chamfering both the inside and outside edges of hypoid gear teeth, Modern Industrial Engineering Company has introduced a machine with three stations. Each has two adjustable, counterbalanced spindles driven by compressed air and mounting small grinding wheels: one to chamfer the inside diameter and the other the outside diameter. At each station are two start buttons which, when actuated, lower the grinding heads and lift the workpiece, which is held in a slowly rotating fixture. At the end of one revolution the spindle is automatically raised and the part lowered for unloading. All three stations function independently and are served by one man. Changes in tooling permit chamfering a variety of straight and spiral bevel gears. Rate of production of the machine is said to be 300 an hour.

Circle 11E on reply card

Modernair Corporation has in production a compact throttling-type valve that screws into either or both exhaust ports of a 5-port, 4-way valve or into the exhaust port of a 3-way valve to control the speed of an air-cylinder piston in one or both directions in the first case and to regulate the piston return speed of a single-acting cylinder in the

"GJ-BOSS"
GROUND JOINT, STYLE X-34
HOSE COUPLING



The female-type coupling you can rely on for tight, safe connections on the big drills; manifolds; jumbos; in caisson work; and all other high-pressure operations. Copper insert in spud fits rounded head of stem, forming soft-to-hard, leakproof metal seal. "Boss" Offset Interlocking Clamp provides powerful grip on the hose—proof against blow-offs. Also available in washer type, and with companion male coupling. Sizes ¼" to 6".

"BOSS" HOSE MENDER
STYLE BM-16

The practical, safe way to quickly restore damaged hose to service. Complete fitting consists of mender tube and two "Boss" Interlocking Clamps. Tube has flanges to engage clamp fingers. Tube shanks have well-defined, smooth corrugations. Thoroughly rustproofed. Sizes ½" to 6".

Stocked by Manufacturers and Distributors of Industrial Rubber Products

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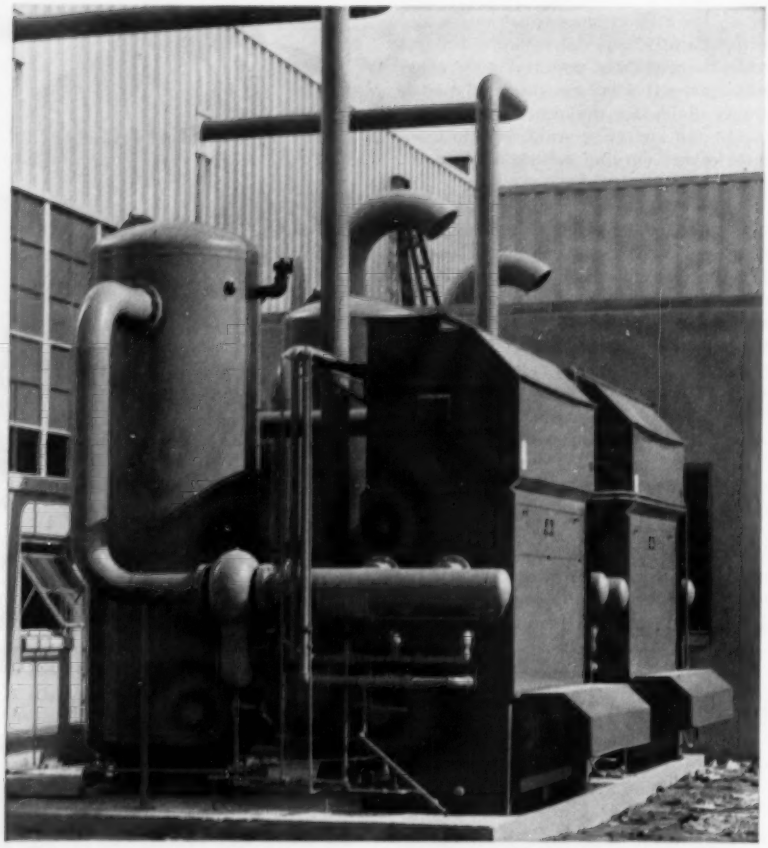

This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR... Lower in Cost Dependably Drier and Cooler Trustworthy for Instrument Use

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient. Its drier air gives you a better operation and lower costs in the use of all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility air systems.

Write for complete information; ask for Bulletin No. 130

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. CA, 405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities

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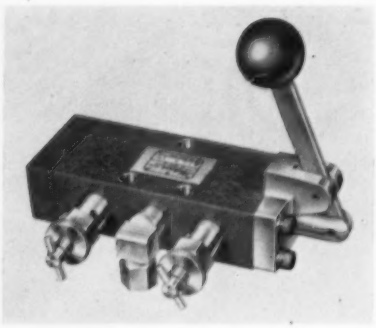


second. Machined from brass bar stock, the Model 500 Exhaust Speed Control Valve is made in ¼-, ⅜- and ½-inch pipe-thread sizes. No tools are required for flow adjustment, and the needle valve can be set and locked by hand.

Circle 12E on reply card

Instead of audible signals that may not be heard in remote workings, the Empire Star Mines Company, Ltd., of Grass Valley, Calif., is using a system that warns the nose of danger. In case of fire or accident, the nostrils of the workers are assailed with the unmistakable odor of amyl acetate, better known as banana oil, that sends them scurrying to safety. The liquid is introduced into the main air-supply line by a Stench Injector developed by the master mechanic of the company's gold mines. By means of it, a controlled quantity of amyl acetate is allowed to flow from a storage tank with a sight-feed glass into an atomizer box through which the air

PHOTO, DU PONT COMPANY OF CANADA, LTD.

DOOMS GLUE POT

This aerosol dispenser of a rubber-resin adhesive may make the glue pot and brush an oddity. A Canadian manufacturer is packaging the waterproof material that can serve many industrial and household needs from sealing cartons to repairing shoes. It is said to be effective on fabric, leather, paper, wood, rubber and smooth metal surfaces. Called Bonad spray adhesive, it is resistant to soap and water but dissolves in dry-cleaning solutions.

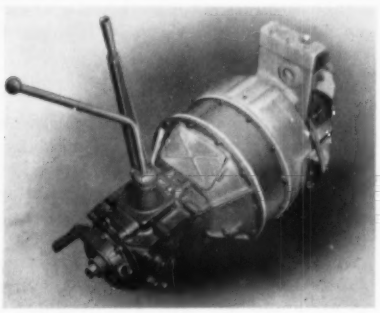
Circle 13E on reply card

stream passes. In the box is a sloping stainless-steel screen, and as the oil drips on the wire mesh it is immediately reduced to fine particles that are carried by the air throughout the workings.

Valves and flanges of pipe lines carrying chemicals will indicate leakage when completely housed in a drumlike transparent cover containing an agent that changes color in the presence of harmful liquids. Called Spray Stop Covers, they are not affected by fumes and also serve to protect workers from spraying chemicals in the case of sudden leaks.

Circle 14E on reply card

Overload protection, high power factor and smooth, positive acceleration are claims made for a new Red Seal hydraulic coupling designed by Continental Motors Corporation for use on compressors, conveyors, blowers, cranes,



crushers, pumps and other industrial machinery. The coupling transmits horsepower and torque through a fluid, thus improving performance characteristics and cushioning both engine and equipment from shock and the application of sudden loads.

Circle 15E on reply card

Exceptional tear strength and lightness for ease of handling are among the advantages claimed for Herculite, a new protective fabric for covering small boats, equipment, truckloads and even baseball parks. Made of nylon and plastic, the material comes in two weights, 12 and 18 ounces per square yard, and in a wide choice of permanent colors. It is said to be fire resistant and waterproof; not to rot or mildew in storage; and to be unaffected by exposure to the weather and acids, grease, oil, etc. Samples of the fabric can be obtained from the manufacturer, Herculite Protective Fabrics, Inc., 140 Little Street, Belleville, N. J.

In addition to its 1-inch-stroke Hand-Air single- and double-acting pneumatic cylinders, The Bellows Company is now offering models with 2-, 3- and 4-inch strokes. Compact and equipped for universal mounting, they are designed for all kinds of clamping, parts positioning and ejecting, and light-duty

SETS THE STAGE FOR FRESH AIR

When the curtain goes up on underground construction, you're all set when Naylor ventilating lines are part of the scenery.

Naylor pipe provides lightweight lines that can be installed faster and easier. What's more, the exclusive Naylor structure permits the use of lighter gauge material to cut your costs without sacrificing performance.

The Naylor one-piece Wedge-Lock coupling is another dependable "prop" that speeds installation of vital air lines. Lines can be assembled with only one side of the pipe in the open and extended rapidly as the work progresses. It's a combination well worth looking into.

Write for Bulletins No. 507 and No. 514.

NAYLOR PIPE

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois
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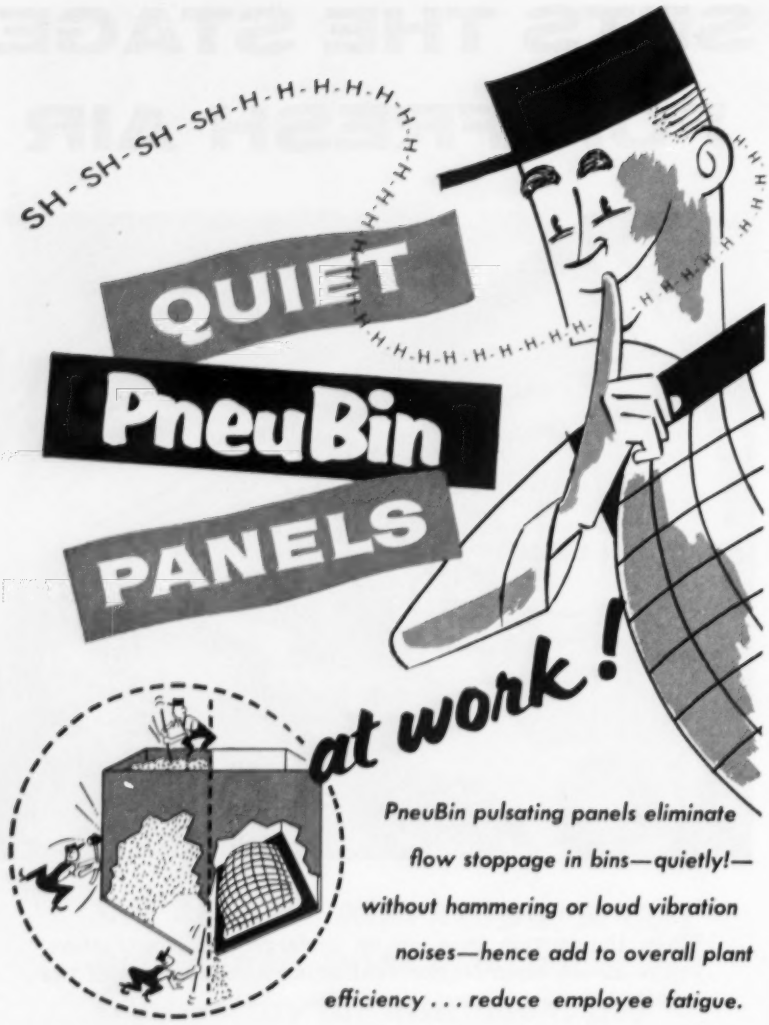


PneuBin pulsating panels eliminate flow stoppage in bins—quietly!—without hammering or loud vibration noises—hence add to overall plant efficiency . . . reduce employee fatigue.

The PneuBin unit consists of steelbacked, neoprene, pulsating panels mounted on the inside wall of your present bins and air controls to regulate the panels' action. By the pneumatic inflation and deflation of the PneuBin panels, the bin contents are positively displaced to insure free flow. After the panels have deflated, the air control unit (operating off the regular plant air supply) starts another cycle of inflation and deflation. The process continues *automatically* at whatever frequency is set on the air controller (this frequency is adjustable).

Send for "Flow Stoppage Report" and free literature. PneuBin engineers will gladly make recommendations with no obligation on your part.

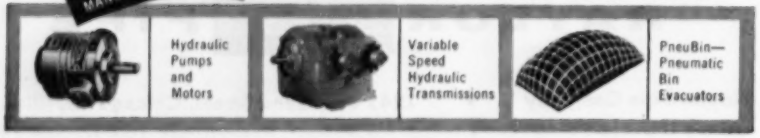
Progress Through Fluid Power by—

GEROTOR

MAY CORPORATION

MANUFACTURERS OF—

1531 MARYLAND AVENUE, BALTIMORE 3, MARYLAND

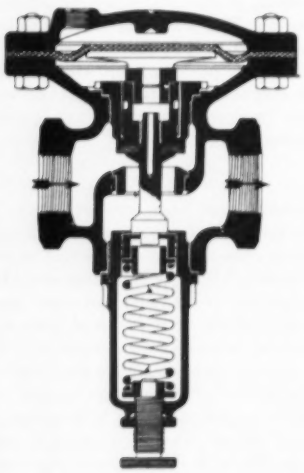


Circle 21A on reply card

tool and feeding operations. The 5/16-inch piston rod is threaded for easy coupling to the work load. All units are said to develop a thrust equal to the air pressure applied. In the accompanying illustration a double-acting model with a 4-inch air-powered advance and return stroke is shown in the back and a single-acting spring-return unit with a 1-inch stroke in the front.

Circle 16E on reply card

The accompanying sectional view shows a new model vacuum regulator, one of two valves recently announced by A.W. Cash Valve Mfg. Corp. The other is a vacuum breaker. The latter is said to hold a predetermined vacuum by automatically admitting atmosphere, other gases or liquids upon the slightest change in vacuum conditions. The regulator is



designed for use in noncorrosive liquid or gas systems where it is desired automatically to maintain a vacuum in the line lower than that received from a pump or other source. Any variation in controlled vacuum is corrected by a corresponding valve movement, thus maintaining inlet vacuum within close limits, it is claimed. Both valves are self-adjusting and supplied in pipe sizes ranging from ½ inch through 1¼ inches.

Circle 17E on reply card

BRIEFS

In the Kiruna Mine in Sweden, air leakage and loss in pressure are reduced by decentralizing the compressor plant. Mining is done by a so-called method of trackless sublevel caving, and air power is supplied by self-contained machines each mounted on its own carriage.

•

It may sound incredible, but we have it on the authority of Gerald Fitzgerald, chief topographic engineer of the U.S. Geological Survey, that only 37 percent of the United States has been adequately mapped even though the work was begun back in 1777. It will take seventeen more years with modern facilities to complete the job at an outlay of $220 million.

•

The same rubber bellows or springs that are being installed on buses for rider comfort and are soon to be incorporated in GMC trucks to lessen cargo damage (see May 1956 issue) are being used to float the floor of a newspaper pressroom to prevent transmission of vibration to other parts of the building.

•

Fill for empty blasthole stopes in the Levack Mine of The International Nickel Company is dropped down an 18-foot hole that was drilled by a Calyx core drill to a depth of 308 feet. The fill consists of gravel taken from an open pit and is delivered to the mouth of the hole by trains each made up of eight 25-cubic-yard cars which are dumped by compressed air provided by the locomotive.

•

Rod-shaped fluorescent tubes with grooves in the exposed side are being manufactured by General Electric Company. Called Power-Groove lamps and thicker than the conventional type, they are said to give twice as much light, length for length, because of their greater surface area.

•

Before planes built by McDonnell Aircraft Corporation are taken aloft they are searched for small tools that may accidentally have been left behind. This is done by aid of a scintilloscope that picks up radiations from radioactive cesium 137 of which a small amount is embodied in each tool.

•

The Cincinnati Baseball Club of the National League has air-conditioned "dugouts" (where the players sit when not on the field) for both home and visiting players, and a part of the facilities occupied by representatives of the press, radio and TV also are cooled for comfort. The dugouts still have open fronts.

•

Less than 10 percent of the $90 million collected annually in parking meters by city governments is used for parking improvements, street repairs or traffic control, according to the American Au-

Yes! and here's how...

Is compressed air-line condensate causing you to lose valuable production time? Do numerous blow-downs add to the cost of operating your compressed air system? Do you have a heavy air-tool maintenance load?

These headaches are common when a compressed air system needs an Adams Aftercooler and Cyclone Separator . . . where your compressor discharges directly into the receiver. With Adams units, your compressor discharges hot, vapor-laden air into the Aftercooler. Here the air temperature is reduced to within 10° F of the cooling water. As a result, excess water and oil vapors are condensed.

The Cyclone Separator removes virtually all condensate from the air as it flows from the Aftercooler. That's because the Adams design achieves a high separating factor — even over wide ranges of flow.

Compressed Air, conditioned by this Adams team — Pipe Line Aftercooler and Cyclone Separator — normally enters the distribution system below the ambient temperature. Thus, there can be no further condensation to cause you trouble.

For Twenty Years the Adams team has given thousands of customers dependable, trouble-free compressed air. So, if your plant has problems due to condensate in your air lines, there's a simple answer. Write for our Bulletin 711 and see for yourself.

R. P. ADAMS CO., INC.

209 East Park Drive • Buffalo 17, New York

R. P. ADAMS COMPANY, INC. JU.-56
209 East Park Drive, Buffalo 17, N. Y.

We have a compressed air condensate problem. Please have your local representative call on us.

Name..... Title.....

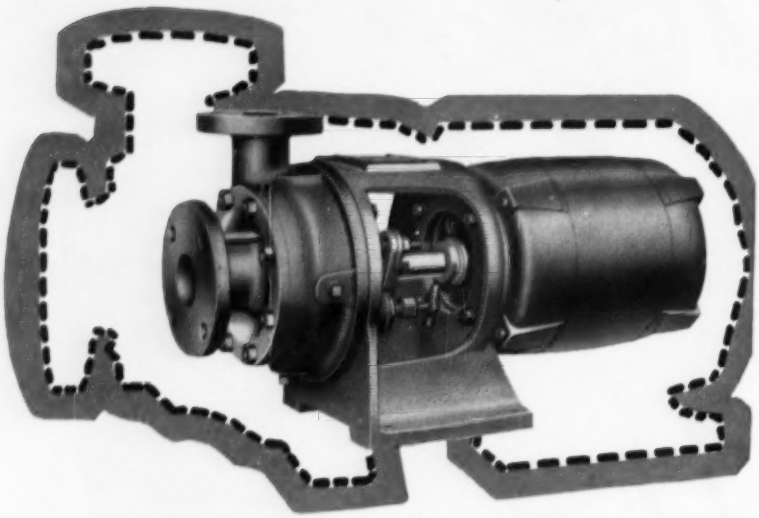
Firm.....

Street.....

City..... State.....

Circle 22A on reply card

You can cut pumping costs



by doing the job with a smaller Ingersoll-Rand

MOTORPUMP

By reducing original cost. Many plant operators say yes, because liquid handling operations can generally be done by I-R Motorpumps of lower horsepower than other pumps.

By saving on weight and space. Both, probably—because Motorpumps are so compact and efficiently designed.

By lowering power consumption. Definitely—many Motorpump users get substantial savings in power over pumps previously used.

By simplifying installation. That's certain—because Motorpumps can be mounted in *any* position . . . on floor, wall or equipment . . . without the need for any special foundations!

You'll find other big I-R advantages in the latest Motorpump catalog. Send for your copy now.

Ingersoll-Rand

9-365 11 Broadway, New York 4, N. Y.

tomobile Association. More than half of the money from the nation's 1,300,000 meters goes for purposes entirely unrelated to easing traffic congestion.

•

DuPont "Teflon," one of the most slippery materials known, is under investigation for possible use in friction bearings so they will never squeak or require lubrication.

•

A new AiResearch barometric altitude control mechanism for airplanes is so sensitive that it will register a change in elevation of as little as 15 inches near ground level and 20 feet in the rarefied atmosphere 60,000 feet above the earth.

•

Two 815-foot-long oil tankers of 83,000 tons deadweight now being built at Kure, Japan, will dwarf any commercial cargo vessel in service today. They will transport Persian Gulf crude oil to the United States.

•

Fishermen's waders for stream or surf made entirely of latex rubber weigh only 2 pounds, as compared with 10 or 12 pounds for conventional rubberized-fabric models. Shoes to wear with them have latex uppers and neoprene nonskid soles. Both articles fold flat for carrying.

•

Uncle Sam will give Free China $4,000,000 to start construction of its largest economic project to date—a $40-million multipurpose dam on the Island of Taiwan. The structure is scheduled for completion in 1960.

•

Four new revolving beacons atop New York's Empire State Building will generate nearly two billion candle power, making them the world's brightest continuous source of light. It is expected that they will be visible from 80 miles away on clear nights.

•

Although India's railroad system has less than one-sixth the mileage of the United States network it carries about three times as many passengers. Last year 1260 million people rode the Indian railways, which have a million employes.

"Whither goest thou?"

Books and Industrial Literature

Ross Operating Valve Company, 120 East Golden Gate Road, Detroit 3, Mich., has listed all JIC symbols for pneumatic valve controls in a 40-page reference book that is available, together with a drafting template guide, for $1.00. Comprehensive in scope, the simplified drawings in each category may be used to designate the pneumatic equipment of any manufacturer, and the guide is an aid in drafting the symbols.

The Fluid Controls Institute, formerly the National Steam Specialty Club, an organization including manufacturers of control valves, regulators, solenoid valves and similar auxiliary equipment, has adopted a standard classification and terminology system for power-actuated valves. The project was undertaken to provide mechanics and operating and instrument engineers with accepted names and terms for everyday use. The result is published in a 12-page booklet which can be obtained from the Institute, Box 191, Decatur, Ill.

As a companion piece to passenger-car service guides, Ingersoll-Rand Company now has available a Truck Service Guide (Form 5097-10). Of 32 pages, it illustrates and describes its multipurpose air and electric Impactools that are designed to help the mechanic do his work with efficiency and dispatch and to reduce maintenance costs. It contains comparative time and cost studies of a number of everyday jobs as performed by hand, air or electric tools that enable service shops to appraise the value of the equipment. For uniformity, the work was done under actual service conditions with the same man handling the different tools in each case.

Circle 18E on reply card

Thermal insulations and refractories for general industrial applications are the subject matter of a catalogue prepared by Johns-Manville for quick reference. It gives information about the composition, physical and thermal properties and sizes of materials for the control of temperatures from minus 400° below zero Fahrenheit to 3000° above.

Circle 19E on reply card

Recording and controlling electronic potentiometer and bridge instruments of the Dynamaster type are illustrated and dealt with in detail in a 64-page bulletin—P1245A—offered by The Bristol Company. It is divided into three sections covering the instruments and principles of operation; sensing elements and special attachments; and equipment in which Dynamasters have been incorporated.

Circle 20E on reply card

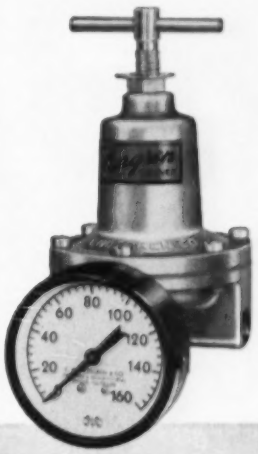
Hypalon, a chemical rubber made by E. I. du Pont de Nemours & Company, is described in an 8-page booklet for industrial designers and engineers. It touches on the composition and manufacture of this new synthetic rubber, outlines the characteristics that insure outstanding service under severe service conditions and shows how these properties have proved of advantage to users of hose, belting, seals, coatings, etc.

Circle 21E on reply card

Now obtainable from Industrial Plastic Fabricators, Inc., is a 20-page illustrated brochure that covers its line of unplasticized, rigid polyvinyl-chloride blowers designed to withstand most chemical fumes and polluted air in a temperature range of 40-140°F. Performance tables on all models from 143

NORGREN
AIR PRESSURE REGULATORS

Accurate, Dependable Control of Air Pressure



There's a Norgren Regulator for Every Air Regulation Need.

All air-operated equipment is designed to operate most efficiently at one specified air pressure. Pressures in excess of this specified pressure result in greater wear, more down-time, higher maintenance cost and waste of air. You can select a Norgren Regulator that will provide the desired pressure at all times, holding it constant even though the line pressure or rate of flow may vary.

How Norgren Regulators Provide Accurate, Trouble-Free Service . . .

1. PRECISION CONSTRUCTION

Norgren Pressure Regulators are precision built throughout to provide accurate pressure regulation under the most rugged conditions.

2. PRESSURE KEPT CONSTANT

Norgren Pressure Regulators respond quickly to sudden demands for greater air volume without an excessive momentary pressure drop.

3. EFFICIENT OPERATION

A baffle plate and siphon tube permits greater air flow with less pressure drop and protects the diaphragm against sudden pressure surges and chatter.

4. LONG-WEARING DIAPHRAGM

The diaphragm in Norgren Pressure Regulators is made of oil-resistant synthetic rubber reinforced with nylon fabric.

5. RELIEVING FEATURE

The built-in relieving feature available on all models safeguards connected equipment against damage through pressure surges—permits downward adjustment of pressure without auxiliary "bleeding" of line.

6. EASY TO INSTALL

Pipe connections are straight through for easy installation. In addition, most models can be completely dismantled without removing them from the air line.

Without obligation, learn how Norgren Pressure Regulators can reduce costs in your plant. Call your nearby Norgren Representative listed in your telephone directory, or **WRITE THE FACTORY FOR NEW NO. 700 CATALOG.**

C.A. Norgren CO.

3407 So. Elati St., Englewood, Colo.

Wherever Air is Used in Industry

NEARLY 400 STANDARD MODELS

NORGREN AIR PRESSURE REGULATORS, RELIEVING

Relieving feature provides added protection against excessive pressure build-up. Permits downward adjustment of pressure without "bleeding" of line. Maximum allowable primary pressure is 400 psi; adjustable delivery pressure is 2 to 250 psi. Pipe sizes—⅛" to 1" inclusive. Series 2AX.

NORGREN AIR PRESSURE REGULATORS, STANDARD

Maximum allowable primary pressure is 400 psi; adjustable delivery pressure is 2 to 250 psi. Pipe sizes—⅛" to 1" inclusive. Series 2A.

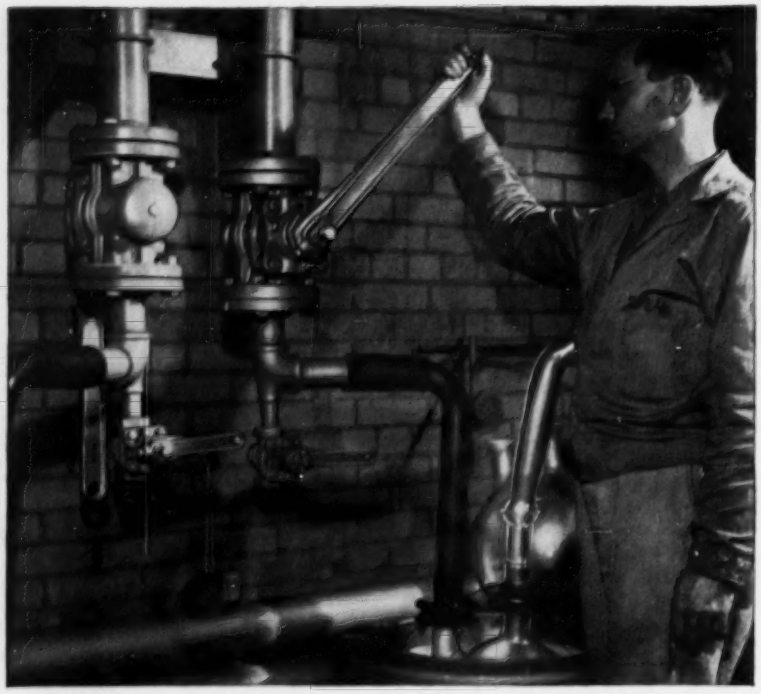
NORGREN AIR PRESSURE REGULATORS, PRECISION

For precise control of air pressure in the range of 0 to 2 cfm. Specially suited for use with air-controlled instruments. Maximum allowable primary pressure is 400 psi; adjustable delivery pressure is 1 to 30 psi. Relieving type. Pipe size—¼". Series 11,400.

NORGREN AIR PRESSURE REGULATORS, PILOT-CONTROLLED

A precisely controlled air cushion provides an extended adjustable range, more accurate pressure regulation, increased capacity in cfm. Maximum allowable primary pressure is 400 psi; adjustable delivery pressure is 2 to 120 psi. Pipe sizes—½", ¼", 1". Series 20AA.

Circle 24A on reply card



WHY ROCKWELL-

Nordstrom VALVES

CUT COSTS

Rockwell-Nordstrom lubricated plug valves *stay* leakproof because they do not depend on uncertain metal-to-metal seating. Ordinary valve seats, even on routine services, soon score or pit, resulting in production hazards and costly maintenance.

Rockwell-Nordstrom valves employ *pressurized lubricant* between the plug and body for a tough, continuous seal that assures leakproof service on lightest gases or heavy slurries. The seat is *never* exposed to the line fluid and lubrication protects against corrosive-erosive material . . . maintenance costs are lower than any other valve. Rockwell-Nordstrom valves are always dependable because pressurized lubricant jacks the plug for perfect seating and instant, quarter-turn operation.

You can get Rockwell-Nordstrom valves in semi-steel, steel, stainless and other corrosion resisting metals in a full range of sizes. They cost no more, often less, than ordinary valves. Write for more details: Rockwell Manufacturing Co., Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Ltd.

Rockwell-Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR *of lubricated plug valve leadership*

Adv. 27 (190) *Circle 25A on reply card*

to 7722 cfm are included, as well as comparative chemical resistance charts listing more than 350 chemicals.

Circle 22E on reply card

A new oil-well pumping starter featuring a combination sequence and program timer, a ventilated overload relay compartment and a gasketed enclosure is pictured and described in Bulletin GEA-6410A being distributed by General Electric Company.

Circle 23E on reply card

Anyone interested in Conforming Matrix Corporation's automatic reciprocating-type spray-painting machine can obtain a brochure about it upon request. It is electrically controlled and designed for spraying areas up to 12 inches wide and 40 inches long.

Circle 24E on reply card

Catalogue 200 obtainable from Atkomatic Valve Company, Inc., describes its complete line of electrically operated 2-way solenoid valves for air, gas, steam and liquid flow control. An engineering guide, it also contains coil and flow charts and lists pressures and applications.

Circle 25E on reply card

Threadwell Tap & Die Company will send free of charge a new Catalogue, No. G55, on its line of gauges. Really a reference book, it is full of pictorial and descriptive information, and a section entitled Engineering Data makes it a valuable addition to any technical library.

Circle 26E on reply card

Engineers, users and buyers of pipe nipples of all kinds should find the new catalogue issued by Pittsburgh Nipple Works, Inc., of interest. In addition to giving many helpful hints to purchasers, it lists prices, carton quantities, weights and ASTM specifications for every class produced.

Circle 27E on reply card

Parker O-Lube, a new material that is said to extend the service life of synthetic-rubber O-rings, is described in Catalogue 5840 obtainable from Rubber Products Division of Parker Appliance Company. The lubricant is especially recommended for low-pressure pneumatic and vacuum systems.

Circle 28E on reply card

Information on its potassium-cyanide solution for electroplating applications is contained in a bulletin offered by the Chemical Division of Koppers Company, Inc. Prepared with the small as well as the large operator in mind, it deals with the product's ease of handling and safety and lists its uses.

Circle 29E on reply card

Complete details and operating capacities of Nucretor, Bondactor and Airplaco concrete gunning equipment is contained in a 16-page catalogue obtainable upon request from Air Placement Equipment Company. Numerous application pictures are shown and answers are given to questions often asked about air-placed or gunned concrete.

Circle 30E on reply card

Catalogue No. 156 announced by Heinrich Tools, Inc., covers its complete line of holding devices, including the Grip Master which, equipped with false jaws and bushings, can be used as the base structure for jigs and fixtures. Featured in the 24-page book are typical problems confronting tool engineers and how they can be solved.

Circle 31E on reply card

In a recent bulletin Wesson Company deals with its new Poweramic oscillating grinder designed for off-hand grinding of standard and special single-point carbide

tools. The machine is equipped with three motors: one for the wheel spindle, one for the grinding wheel and one for the self-contained coolant pumping system. It is said to take the effort out of grinding and to boost output.

Circle 32E on reply card

In a new brochure, No. 1-56, Taylor-Wharton Division of Harrisburg Steel Corporation illustrates and describes its line of Tisco manganese-steel sprockets and points out the advantages of those with replaceable tooth segments because they eliminate the need of removing an entire sprocket from a shaft when repairs are required.

Circle 33E on reply card

Under the self-explanatory title of *Comparison of Carbon and Alloy Steels for Pressure Vessels*, Lukens Steel Company has published a booklet that is intended to assist designers and engineers choose the steel in their equipment planning that will combine economy and light weight with efficiency.

Circle 34E on reply card

Westinghouse Electric Corporation is offering Booklet B-1425 describing its Precipitron electronic air cleaner for commercial and industrial applications. It tells how air is cleaned by this method, gives installation and maintenance data and explains a new feature—movable nozzle washing and adhesive application—that permits these cycles to be controlled from outside the unit.

Circle 35E on reply card

A 44-page booklet containing handy multicolor tables for quick selection of variable-speed Texrope drives has been released by Allis-Chalmers Manufacturing Company. Bulletin 20P50 also includes data on drive principles, horsepower-rating tables and a speed-range table showing the variation in rpm when using two Vari-Pitch sheaves in combination.

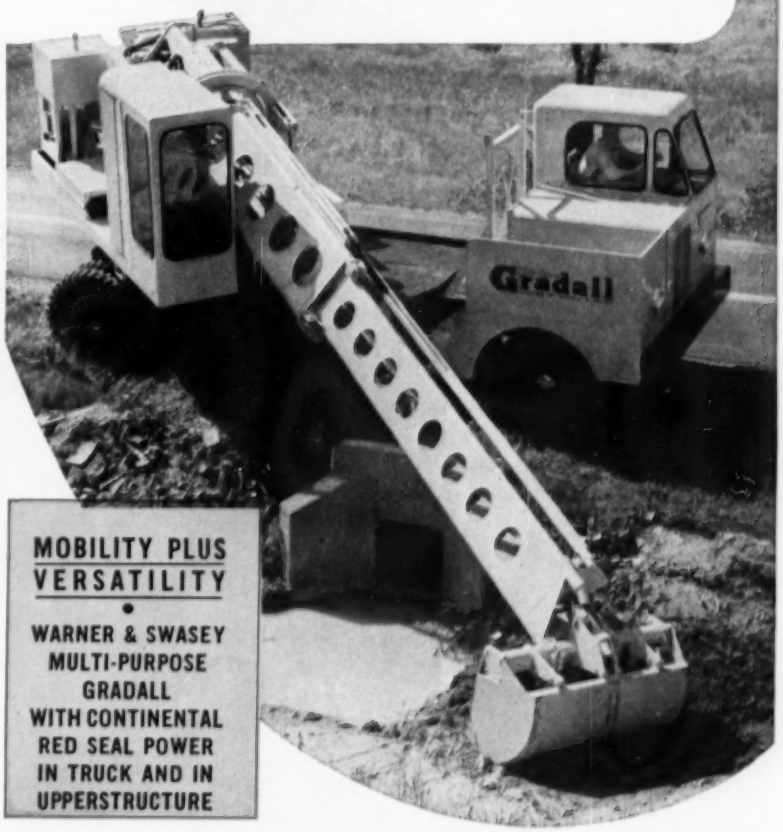
Circle 36E on reply card

How industrial filters can lower production costs is the theme of a bulletin, No. 651, prepared by R. P. Adams Company, Inc. In addition to its regular models, the booklet shows sectional views, installation drawings and operational diagrams of its new line of IWF filters. Also included are case histories ranging from filtering city water to filtering recirculation water from cooling towers and spray ponds.

Circle 37E on reply card

"What a day! Got fired from my job, my wife left me, lost the biggest bass I've ever hooked—would have gone 10 pounds too!"

Changing the Face of the World with CONTINENTAL RED SEAL POWER



MOBILITY PLUS VERSATILITY

•

WARNER & SWASEY MULTI-PURPOSE GRADALL WITH CONTINENTAL RED SEAL POWER IN TRUCK AND IN UPPERSTRUCTURE

Wherever you go these days, you see men at work re-shaping the landscape with the aid of modern construction machines. And no matter what the specific job—clearing land, ditching for irrigation, grading for railroads and highways, laying pavement or wrecking buildings—you'll note a pronounced swing, of late, to equipment with Continental power. The adoption of dependable Red Seals—gasoline or Cushioned Power Diesel—by more and more builders of construction and industrial equipment, reflects a spreading recognition, on the part of machine users, of this basic fact: There's a vast difference, in performance, dependability, economy and upkeep cost, between the ordinary engine and the Continental Red Seal that's engineered and built for the job.

•

SERVICE FACILITIES AND RED SEAL PARTS AVAILABLE EVERYWHERE

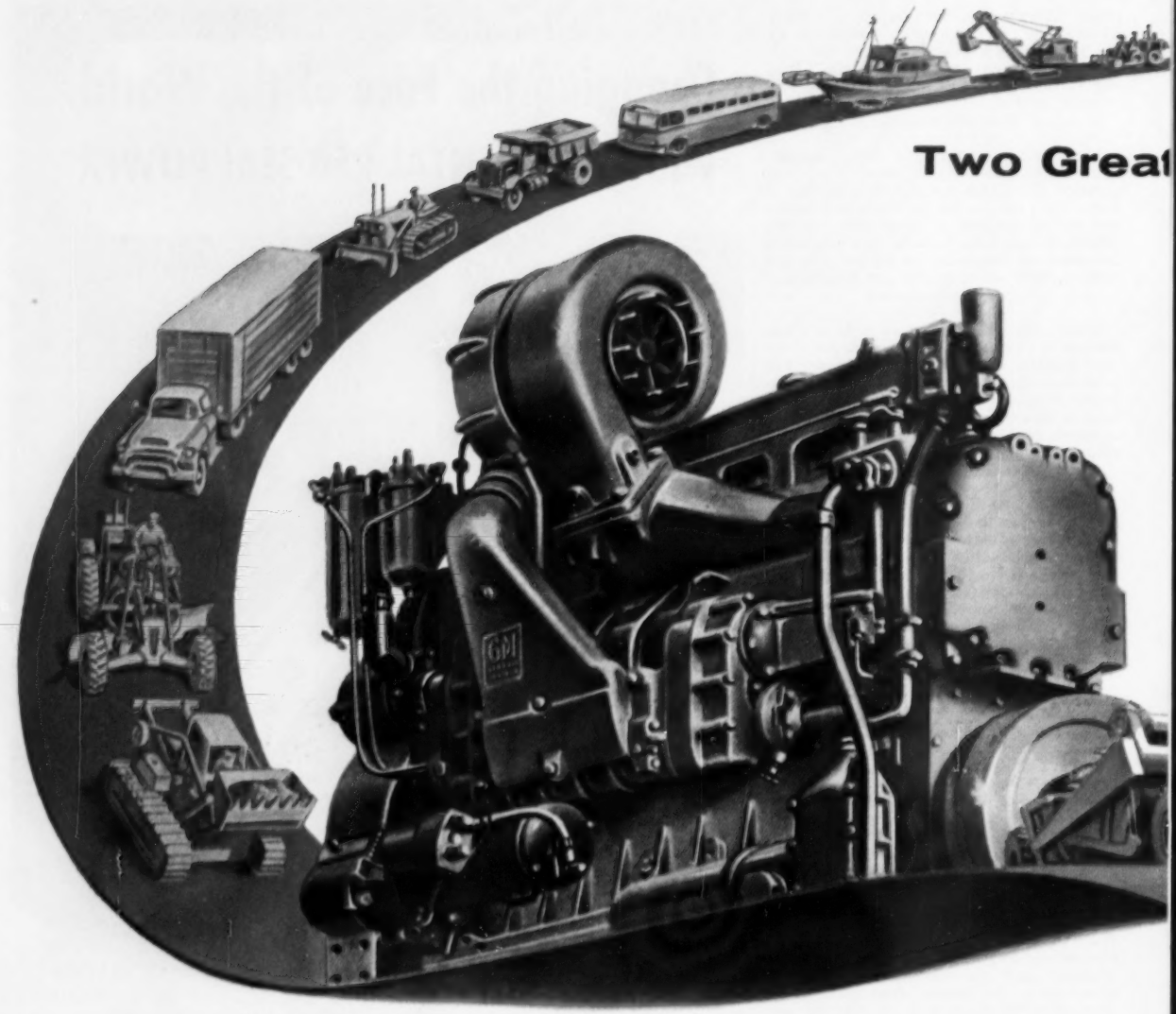
CONTINENTAL MOTORS — Powerful as the Nation — AMERICA'S STANDARD

Continental Motors Corporation

MUSKEGON • MICHIGAN

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
8219 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

Circle 26A on reply card



Increased Power—Decreased Fuel

Here's exciting news for power users—great new 4- and 6-cylinder GM Detroit Diesel engines that represent another long forward step by the leader in the Diesel engine field. With this new, more efficient Detroit Diesel Turbopower you can have up to 17% more power with no increase in fuel consumption—or the same power output with fuel saving up to 15%.

Detroit Diesel engineers have Turbo-charged 2-cycle Diesels by combining an exhaust-driven turbine with the engine blower to deliver a larger supply of fresh air to the cylinders. Result: improved combustion, freer engine breathing, quieter and more efficient performance in the higher speed ranges.

Turbopower Diesels are additions to Detroit Diesel's time-proved Series 71 line, world's most widely used Diesel engines. The four-cylinder Turbopower Diesel delivers 171 H.P. at 2300 R.P.M.; the six-cylinder engine produces 280 H.P. at 2300 R.P.M.

To truckers Turbopower means speedier, more economical movement of big payloads.

To boatmen it means faster speed or longer cruising range—more room for cargo.

To contractors and other industrial users it means greater work output from higher-powered engines or improved economy.

For the full story of 2-cycle Turbopower, write us or call your nearest GM Detroit Diesel Distributor or Dealer.

AMERICA'S LARGEST BUILDER OF DIESEL ENGINES

New Engines Added

to General Motors 2-cycle Diesel Line

Detroit Diesel Turbopower

ARE YOUR AIR COSTS UNDER CONTROL?

Do you know when your air tools or compressor are in need of repair or replacement?

The chances are you don't unless you have a New Jersey Compressed Air Meter—

TOOL-OM-ETER or DRILL-OM-ETER
in your Repair or Test Department.

Why not investigate the advantages our TOOL-OM-ETER or DRILL-OM-ETER can give you, both in cutting costs and in improving maintenance schedules?

Write for Bulletin A-8

We SPECIALIZE in compressed air devices, including the "DriAir" Separator for automatically removing the water from compressed air lines. Ask for Bulletin D-A.

NEW JERSEY METER CO.

"Specialists in Compressed Air Devices"

PLAINFIELD, NEW JERSEY

Circle 27A on reply card

SAFETY FIRST

that's built to last . . .

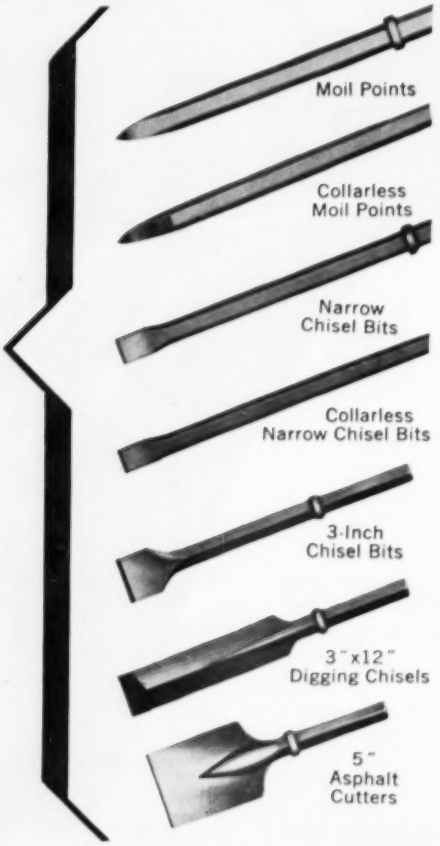
I-R SPARK-RESISTANT

paving breaker tools of FORGED beryllium copper

WHEREVER sparks mean DANGER, you can play it safe – and still get maximum tool life – with I-R Spark-Resistant Paving Breaker tools. That's because they are FORGED – not merely cast – of special, high-strength beryllium copper alloy. A trial order will quickly demonstrate their superiority. Write for Bulletin 4173.

5-383

Ingersoll-Rand
11 Broadway, New York 4, N.Y.



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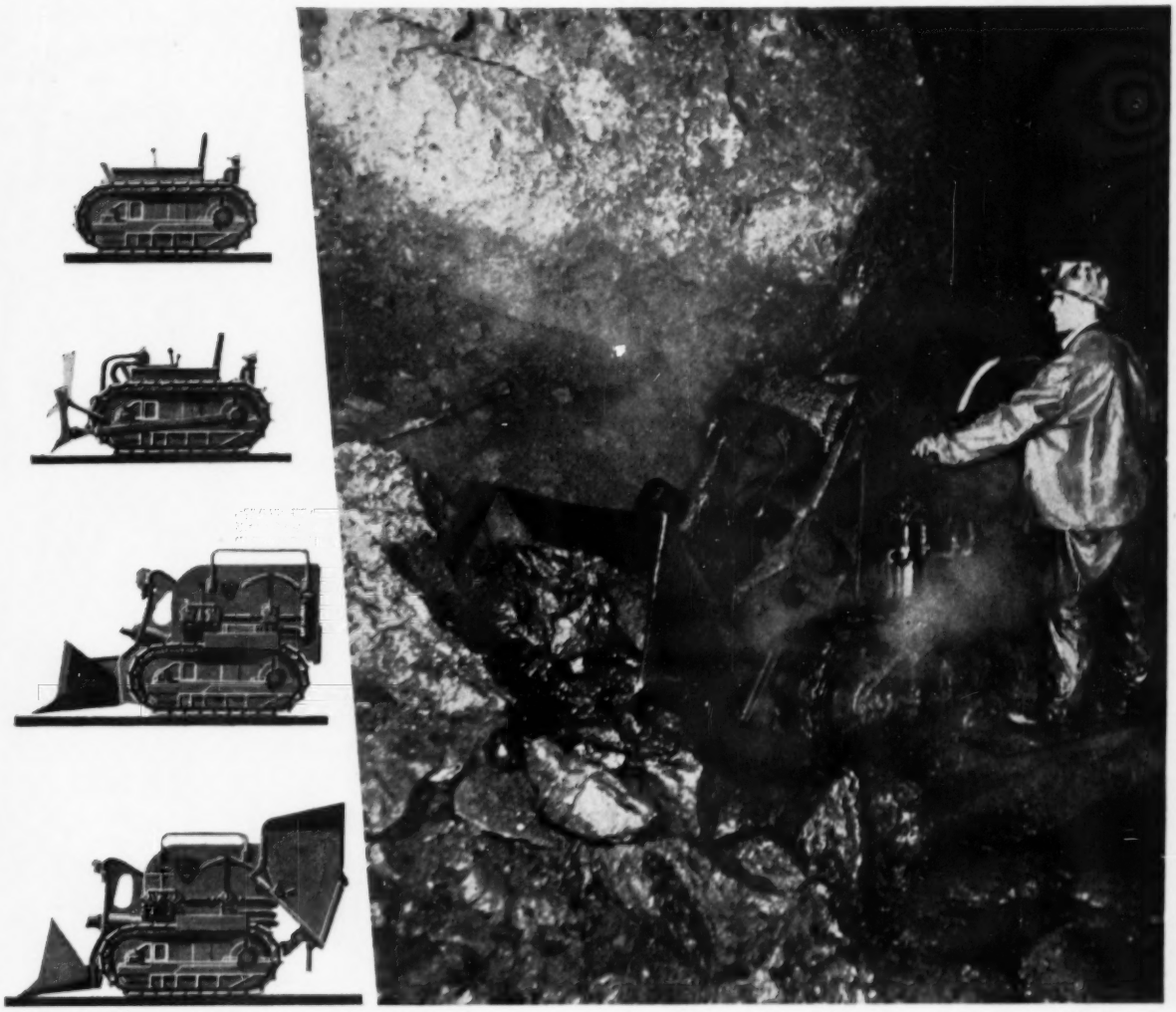

Fast, Economical EIMCO 630's Introduce New Era Underground

Eimco 630's designed and built to Eimco's traditionally heavy-duty standards, are being used as tractors, excavators, bulldozers, jumbos and many other mining tools to speed up development, production, shaft sinking or other operations that tend to reduce costs.

New records have been established in all phases of mining where the 630 Eimcos have been used. Operators have said "It's working out much better than we had ever expected." The 630 is ideal for excavation and loading in large stopes and is small enough to be taken up man ways for work in remote areas of the mine.

The Eimco 630 has many new design features; some of them are: all alloy steel construction, air or AC electric power, independent track control, track oscillation with all attachments, easy accessibility and heavy shafts with oversize anti-friction bearings.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-200

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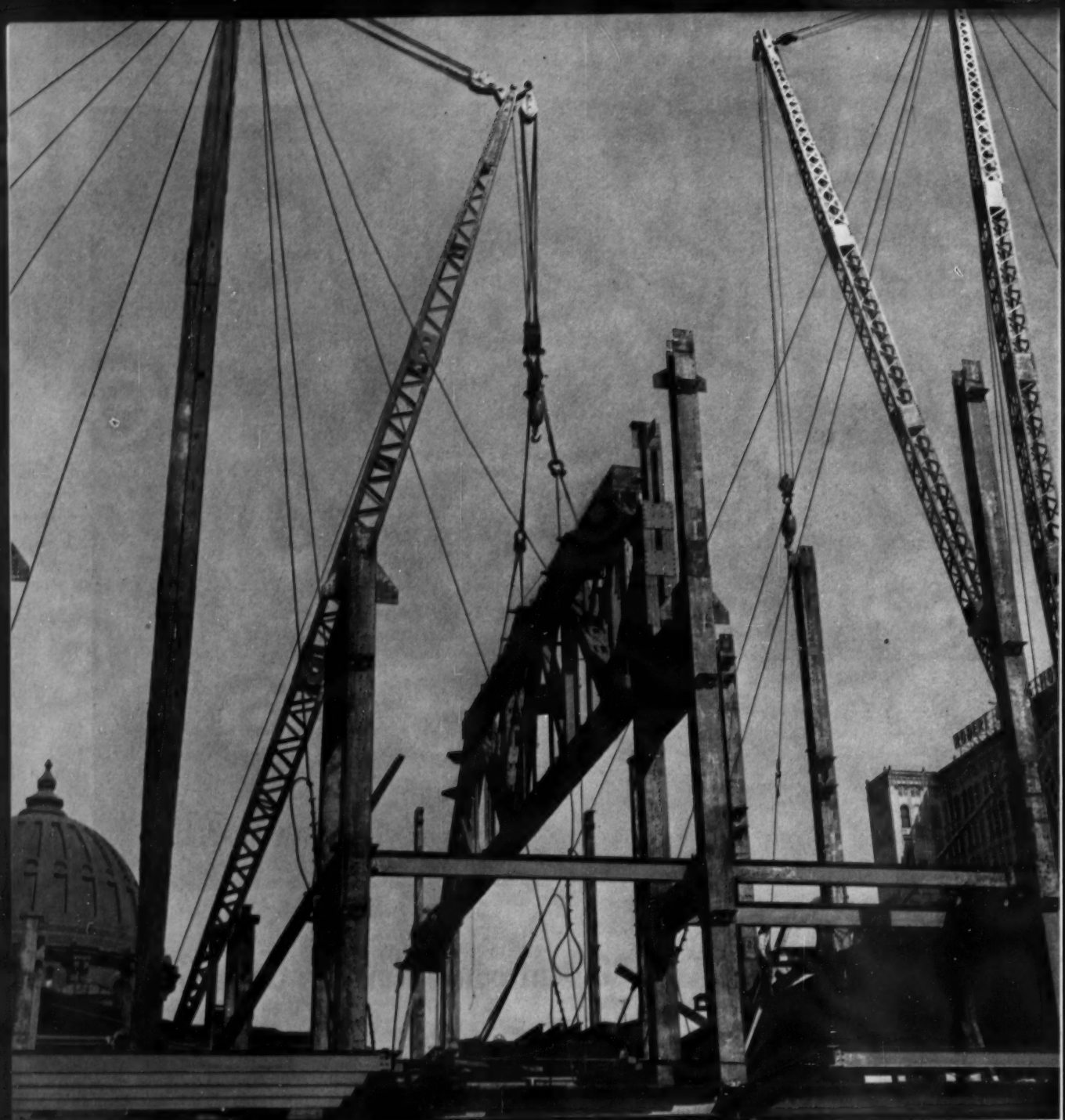


Architects for new Sheraton Hotel: Perry, Shaw, Hepburn and Dean, Boston; Structural Engineer: Maurice A. Reidy, Boston; General Contractor: McCloskey and Co., Philadelphia

Wire Rope at Work—Philadelphians are soon to have a great new hotel—the Sheraton. A 22-story building with de luxe features from lobby to roof, the Sheraton will be a unit of Penn Center, in the very heart of the city. It is to cost approximately $14,000,000.

Here is a picture taken as the steel skeleton was going up. It shows the erection of a 53-ton fabricated truss—one of five designed to support the ballroom ceiling and upper floors of the building. Muscle for the job was supplied by Bethlehem wire rope, Purple Strand grade, which has the strength and fatigue-resistance for even the heaviest lifts. As a matter of fact, it could hoist such trusses all day long and still be ready for more.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

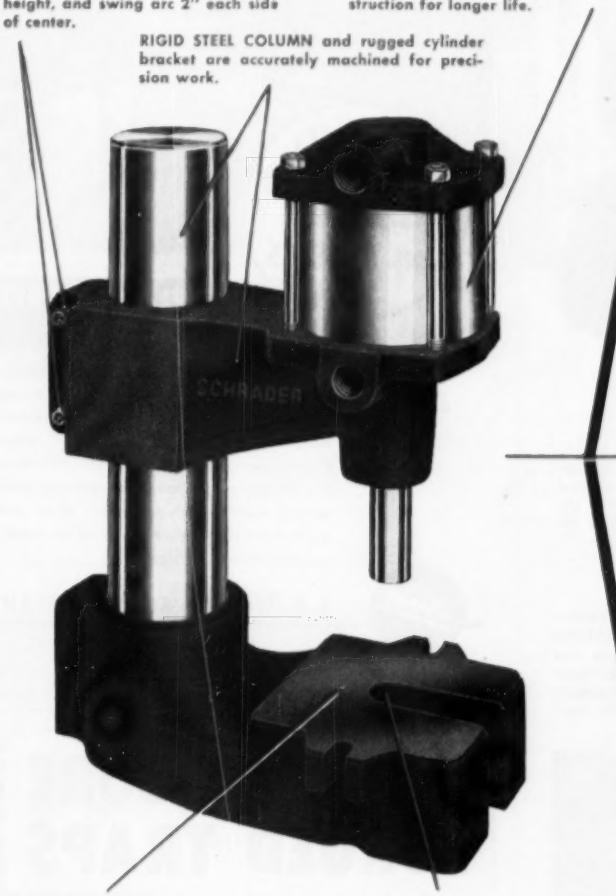
Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING

TWO-BOLT CLAMPING adjusts easily, positively from 0" to 7" in height, and swing arc 2" each side of center.

HEAVY-DUTY CYLINDER with extra heavy wall, tie rods and piston construction for longer life.

RIGID STEEL COLUMN and rugged cylinder bracket are accurately machined for precision work.



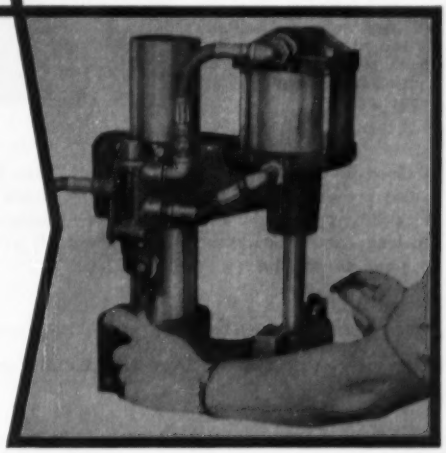
HEAVY, RUGGED BASE forms sturdy foundation for large machined-surface table area.

SPECIAL RECESS IN TABLE provides for punch-through operations.

NEW SCHRADER AIR PRESS

It's compact and power packed!

It stamps, coins, broaches, rivets, stakes, presses, shapes, bends, assembles—*many other uses!*



Modern "muscles" of compressed air never tire . . . get more work done at less cost!

This modern Air Press has unlimited possibilities for speed, power, positive performance. Available as single acting for impact jobs; double acting for squeeze and power withdrawals. It requires minimum space, next to no maintenance, is extremely versatile in adapting to operating controls. Can't be beat for low cost practicality.

Important feature: Control and speed of the extra heavy cylinder and ram can be varied as necessary, by using standard Schrader Air Control Accessories that adjust in seconds.

Write for Catalog data describing Air Press fully—including variety of controls, accessories and prices. You'll be surprised at the low prices!

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
470 Vanderbilt Avenue, Brooklyn 38, N. Y.

Schrader®
ESTABLISHED IN 1844

LEADERS IN AIR CONTROL SINCE 1844

Circle 30A on reply card

Circle 31A on reply card

"MINE KING"

The Name to Remember When Buying Air Hose

STRONG!

Molded - and - braided construction, with materials and workmanship meeting the very highest standards for quality and reliability.

TOUGH!

Extra durable smooth brown cover withstands severest abrasive wear; resists the shock of falling rock, tools and timbers; and prevents penetration of water into carcass.

VERY FLEXIBLE!

Easier to handle under crowded, tight-spot drilling conditions, and when coiling for movement between locations.

LONG LENGTHS!

Availability in long lengths . . . up to 500 feet. . . permits "Mine King" to be used with fewer intermediate connections, reducing the time required for coupling and uncoupling.

A Goodall "Standard of Quality" product, "Mine King" can be relied upon to carry a full, uninterrupted supply of power to rock drills, pavement breakers and other air tools, and to stand-up longer under severest wear and abuse. It will pay you to buy and use it! Sizes ½", ¾" and 1".

If it's GOODALL, it MUST be Good!"

Contact Our Nearest Branch for Details and Prices

Standard of Quality—Since 1870

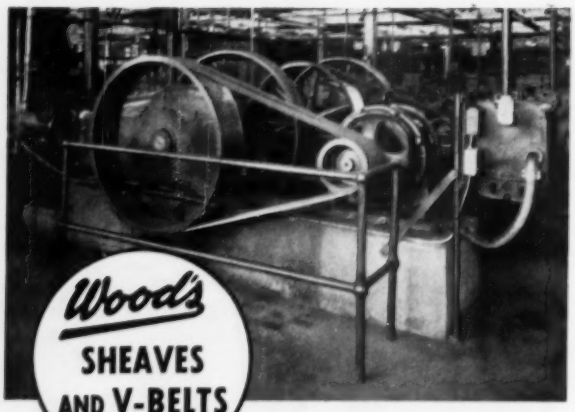
HOSE • BELTING • FOOTWEAR • CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

Branches and Distributors Throughout the United States and in Canada

Circle 32A on reply card



Wood's SHEAVES AND V-BELTS

- LESS POWER REQUIRED
- MORE EFFICIENCY

When you specify Wood's V-Belts and Sheaves for your compressor drives you can rest assured that every single belt is tested and perfectly matched for uniform cross section, proper length and same degree of stretch. All sheaves are of quality grey iron, machined and finished with the most modern equipment. As for price, you'll find it right. Write today for the name of nearest Wood's Distributor.

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Cambridge, Mass. Newark, N. J. Dallas, Texas Cleveland, O.

Circle 33A on reply card

HIGH PRESSURE FORGED TRAPS

for Automatic Drainage of Air and Gas Systems at Pressures to 2000 lbs.

1. BALL FLOAT TRAPS

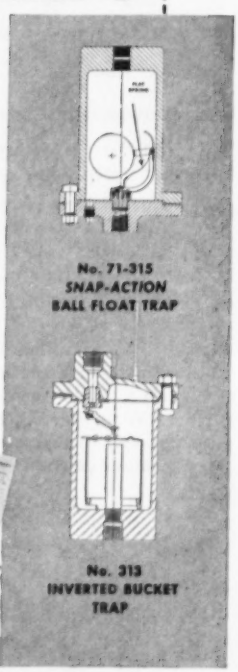
a. *Snap-Action*—to 1000 psig. Spring-powered valve snaps open and closed. No hunting or dribbling. Not held open by fine dirt.

b. *Direct Action*—to 1500 psig. Recommended where no oil or dirt are encountered.

2. INVERTED BUCKET TRAPS—pressures to 2000 psig. None more dependable—not adversely affected by dirt or heavy oil.

Submit your problem for detailed recommendation.
ASK FOR BULLETIN 2021.

ARMSTRONG MACHINE WORKS
885 Maple Street
Three Rivers, Michigan

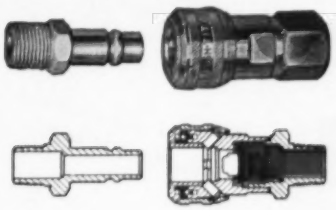


ARMSTRONG *Air and Gas* TRAPS

Circle 34A on reply card

SPECIFICALLY ENGINEERED...
NEVER MERELY ADAPTED...
FOR EACH PARTICULAR
TYPE OF APPLICATION

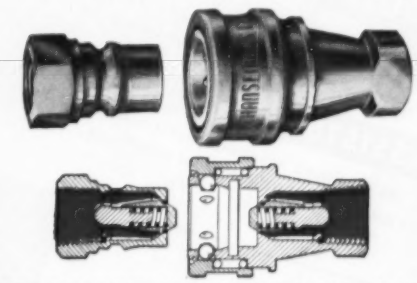
HANSEN
QUICK-CONNECTIVE COUPLINGS



ONE-WAY SHUT-OFF

Shuts off one side of line

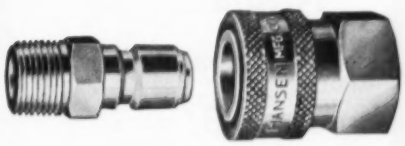
Gives quick connection and disconnection, with instant automatic flow or shut-off. To connect Coupling and open line to flow of fluid, merely push Plug into Socket. To disconnect, a slight pull on sleeve releases Plug and shuts off supply end of line.



TWO-WAY SHUT-OFF

Shuts off both sides of line

To connect, pull back sleeve and push Plug into Socket. Identical torpedo type valves permit free flow of gas or liquid through Coupling. To disconnect, pull back sleeve . . . Coupling immediately disconnects, valves automatically seal both ends of line. Female pipe thread connections from ⅛" to 1". Available in brass or steel.



STRAIGHT-THROUGH COUPLING

Provides quick connection and disconnection, but does not have shut-off feature. Sizes, ranging from ¼" to 2½", carried in stock. Two special types of straight-through steam Couplings also available—one for low pressures, and one for high pressures.

Quick-Connective Fluid Line Couplings for
AIR • OIL • GREASE • HYDRAULIC FLUIDS
REFRIGERANTS • VACUUM • STEAM • OXYGEN
ACETYLENE • GASOLINE • COOLANTS • WATER
Write for Catalog

HOSE CLAMPS • HOSE CLAMP PLUGS
HOSE CLAMP SOCKETS • HOSE CLAMP COUPLINGS

SINCE 1915 ®

Representatives in Principal Cities
QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Circle 35A on reply card

"You can't get a Better Boiler Box Score"

Says Stanley D. Loomis, Chief Engineer of The United Piece Dye Works, a leader in the field of textile dyeing, finishing and printing. Of course, he's referring to the C-E Package Boiler, Type VP—installed in the newest and most modern United Piece Dye Mill at Charleston, South Carolina. His box score for 1955 appears at the right.

SCORE CARD

AT BAT

3 shifts a day, 6 days a week without a single unscheduled outage.

RUNS

around the clock with a quick response to load change and an ability to sustain a high overload capacity while producing high quality steam.

HITS

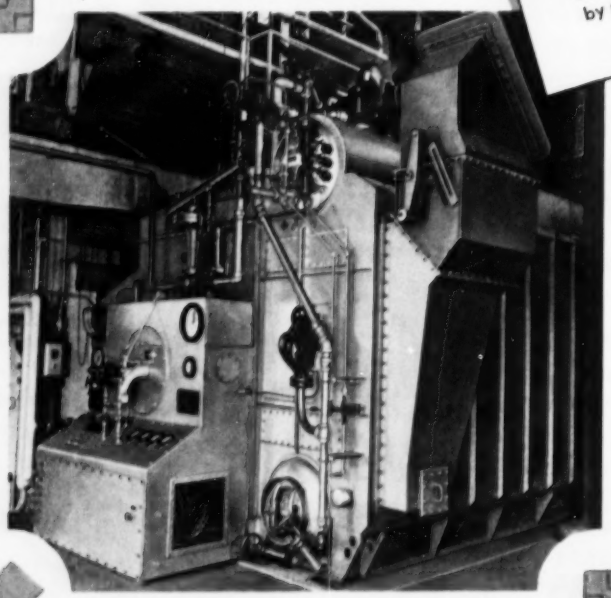
the performance mark. C-E's prompt service and complete cooperation matches the quality of the boiler.

PUT OUTS

of maintenance and repair bills are assured by the boiler's conservative design and built-in advantages. To date there have been no repair bills at all.

ASSISTS

in the continued full-production operation of the plant by meeting every steam need unfailingly.



Need a Package Boiler? See C-E! You can't get a better boiler box score.

8-9118

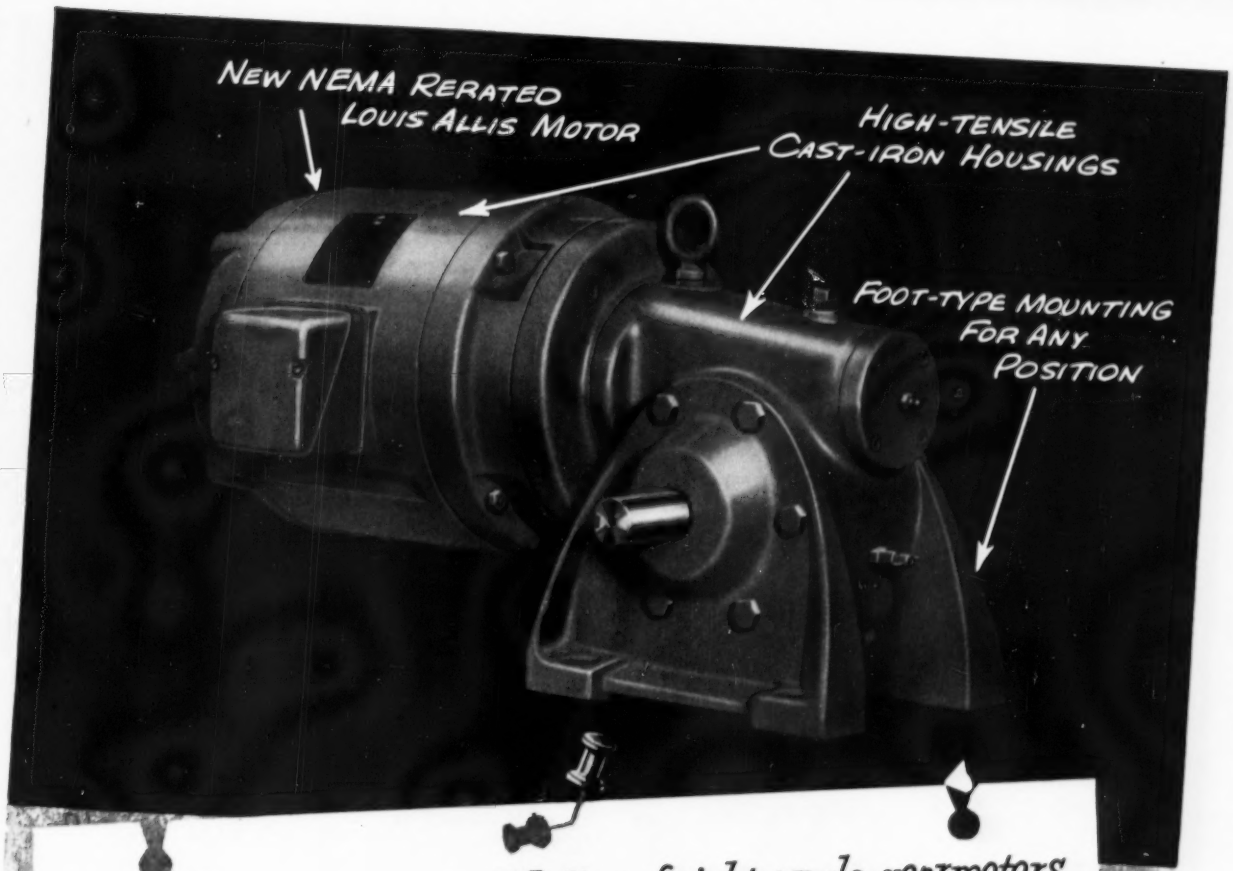
COMBUSTION ENGINEERING

Combustion Engineering Building 200 Madison Avenue, New York 16, N. Y.

CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.

STEAM GENERATING UNITS • NUCLEAR REACTORS • PAPER MILL EQUIPMENT • PULVERIZERS
FLASH DRYING SYSTEMS • PRESSURE VESSELS
HOME HEATING AND COOLING UNITS • DOMESTIC WATER HEATERS • SOIL PIPE

C-E



Louis Allis announces its L.A. line of right-angle gearmotors

Now available with new NEMA rerated L.A. motors for all applications — in sizes from 1/3 to 30 hp

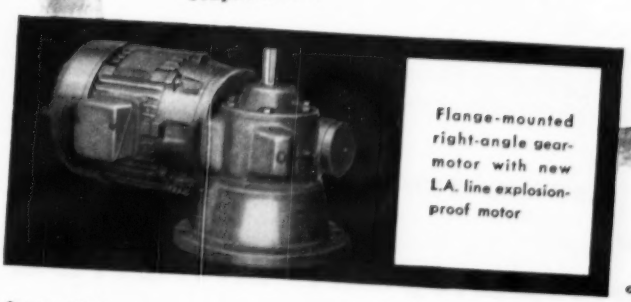
Before we go into the many design features of this compact gearmotor, let's take a look at a few other advantages:

First of all, you can get either foot- or flange-mounted units. Secondly, you can have any motor enclosure you want. And finally, you can have any electrical or mechanical modification needed for any specific application.

In other words, here's a line of gearmotors ruggedly designed, versatile and efficient—to give you a sound answer to your right-angle gearmotor drive problems. Here's why:

- Both gear and motor housings are made of high-tensile cast iron to provide maximum strength, rigidity, and compactness.
- The worm, carefully machined from hardened alloy steel, is ground to close tolerances to give greater efficiency and longer life.
- The worm gear is cut from a high grade of wear-resistant alloy bronze.
- A double-row angular contact bearing and a ball bearing provide for radial and thrust loads on the worm shaft.
- The output shaft is mounted in tapered roller bearings for maximum load-carrying capacity.
- Ample oil-bath lubrication assures longer life and minimum maintenance.
- Special oil seals on all shafts keep the oil in--dirt out and permit any mounting arrangement.

Here's a line of right-angle gearmotors that's very easy to apply. Standard speed range from 7-1/2 to 300 rpm--special speeds also are available.



Flange-mounted right-angle gearmotor with new L.A. line explosion-proof motor

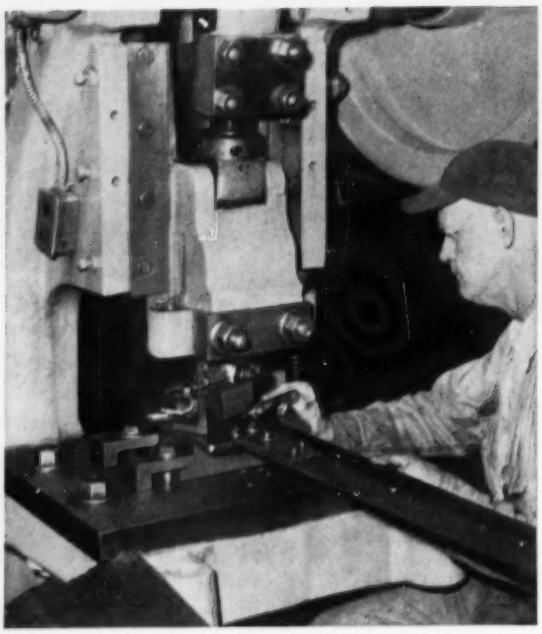
GM-103

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

Circle 37A on reply card

Bits of Crucible Silicon-Manganese alloy steel shown in holder. They are produced by McLaughlin Manufacturing Co., Inc., Joliet, Illinois.

Operator is shown feeding 7-foot strips of steel into punch press. Crucible furnishes this steel in a special shape designed by McLaughlin engineers. After forming to finished size, the bits are heat treated and the point and cutting edge are sharpened by hand.



special
CRUCIBLE
alloy
steel

gives bits maximum impact and abrasion resistance . . .

Cutting through abrasive materials like coal, soft limestone and shale demands a *special* steel. A steel that's hard without being brittle – that will take and *hold* a keen edge.

That's why Crucible produces a *special* Silicon-Manganese type alloy steel for the McLaughlin Manufacturing Co., Inc., manufacturers of these bits. It's a steel designed for optimum shock and abrasion resistance.

After McLaughlin tested Crucible's special alloy in the coal fields, their verdict was "This Silicon-Manganese steel is the finest alloy steel available."

Crucible will be glad to produce a *special* steel to meet your particular needs, too. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 38A on reply card

In Minnesota Taconite...and the World Over

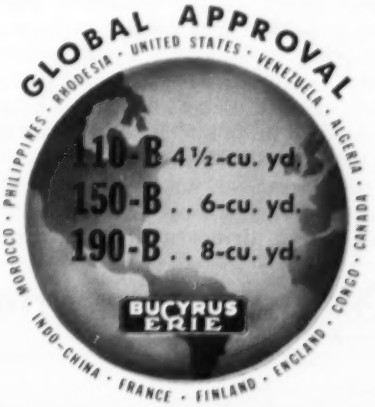
Bucyrus-Erie Ward Leonard Electric Excavators Help Boost Output the Low-Cost Way

Swinging an 8-yd. dipper, this Bucyrus-Erie 190-B shovel is loading taconite into ore cars near Virginia, Minn. Like other Bucyrus-Erie Ward Leonard electric shovels, it has advanced-design features that keep production up and costs down.

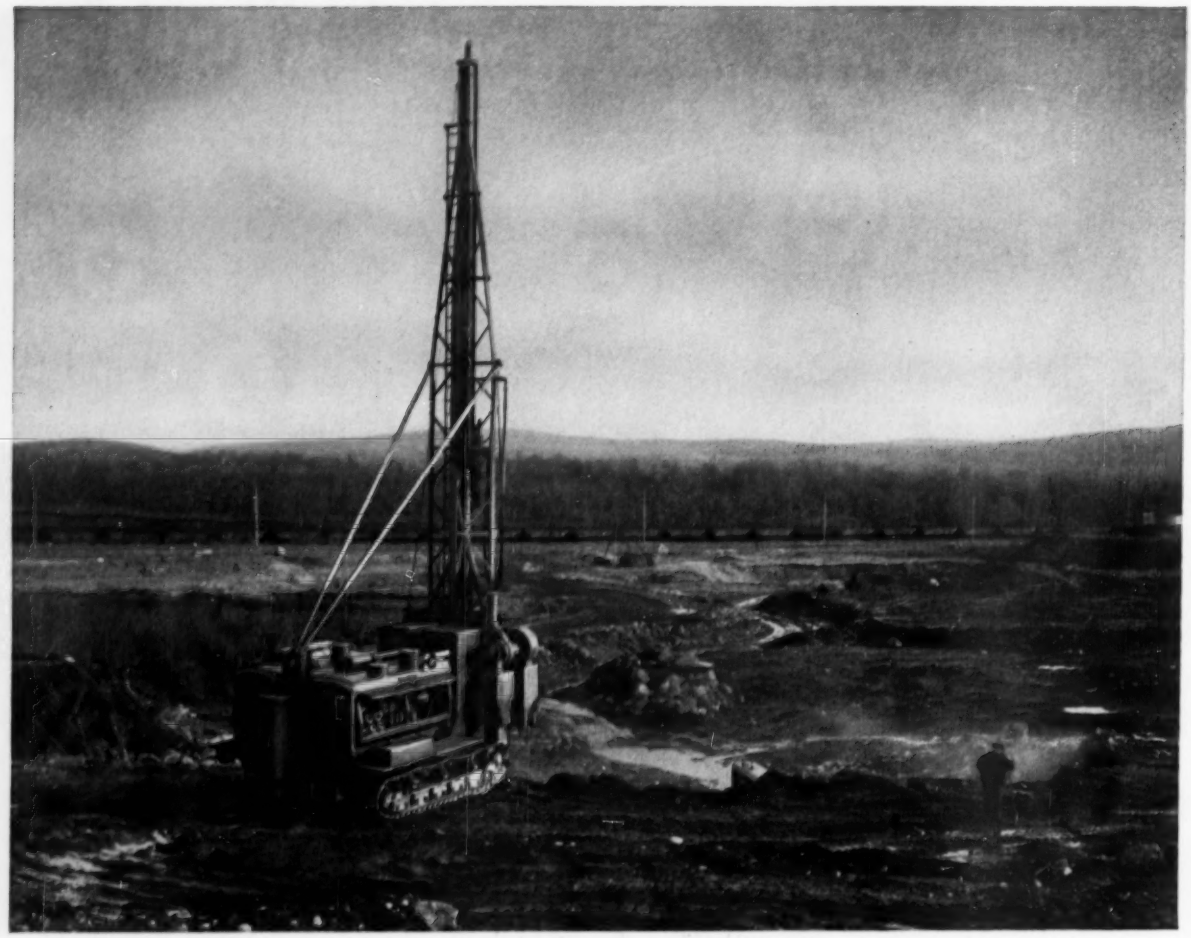
Its front-end design provides plenty of strength without deadweight, to move more material with less effort. Ward Leonard control assures rapid acceleration and deceleration for high-speed, coordinated operation. There is extra torque and ample usable power whenever needed.

In every feature, from boom point to treads, there's strength for low maintenance and maximum time on the job. Let us give you the facts on the right size Bucyrus-Erie shovel for keeping output up and costs down in your mining operations.

94L56C


GLOBAL APPROVAL
MOROCCO · PHILIPPINES · RHODESIA · UNITED STATES · VENEZUELA · ALGERIA · CANADA · CONGO · ENGLAND · FINLAND · FRANCE · INDO-CHINA
110-B 4½-cu. yd.
150-B . . 6-cu. yd.
190-B . . 8-cu. yd.
BUCYRUS ERIE

BUCYRUS-ERIE COMPANY •
• South Milwaukee, Wisconsin



Highly maneuverable, the self-propelled Ingersoll-Rand Quarrymaster is powered by two 415 cfm heavy-duty air compressors. In only minutes it moves from one hole to the next on air-operated tracks.

Nickel alloy steels help Quarrymaster drill blast holes that speed-up output

Operators of this open pit mine in upper New York State save time, sink fewer blast holes, and yet substantially step-up ore output of the property.

The Quarrymaster puts down large diameter holes thus making it possible to drill them much farther apart, center-to-center, and still secure equal or better fragmentation than conventional drills which put down a closer pattern of smaller holes.

Heat-treated nickel alloy steels help the Quarrymaster drill up to a 6″ hole at a rate of 10 or more feet per hour in the hardest rock . . .

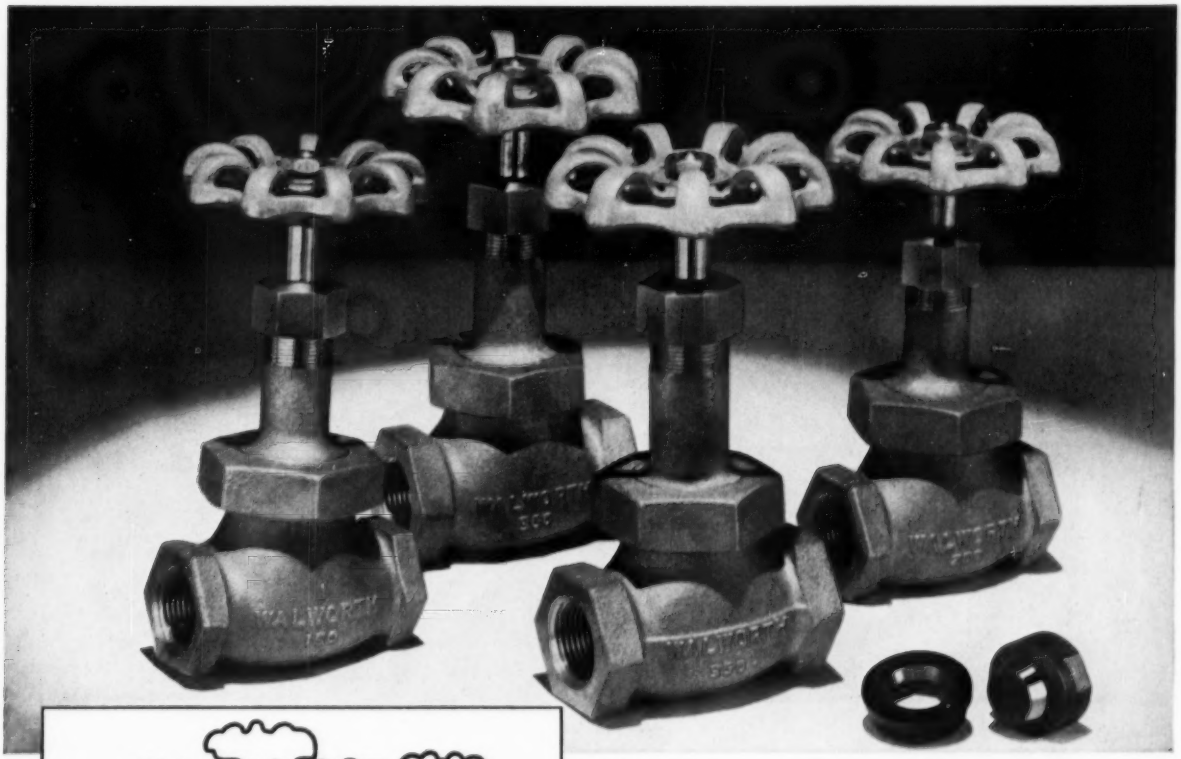
And in relatively soft rock it sinks holes at rates up to 80 feet per hour. The heart of this Quarrymaster is an air-operated piston drill, employing hard, tough nickel alloy steels for vital parts.

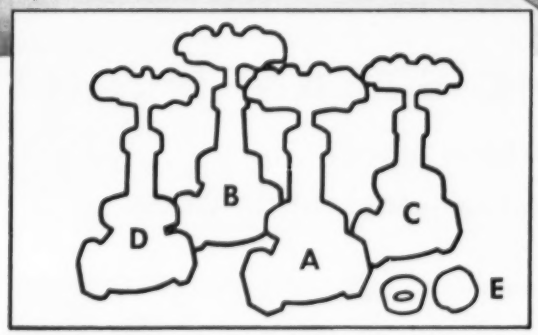
Take its nickel alloy steel piston, for example. This part withstands continuous brutal battering by a tremendous load of more than 200 heavy blows per minute.

Rifle bar and other components, likewise are made of nickel steels to withstand correspondingly tough operating conditions.

Where use means abuse . . . as in the Quarrymaster . . . you can improve specific properties in many metals by alloying with nickel alone or in combination with other alloying elements. Send us details of your metal problems . . . we'll be glad to help you with suggestions for your specific applications.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.





A — No. 225P . . . . . 350 WSP 550F, 1000 WOG
B — No. 260P . . . . . 300 WSP 550F, 600 WOG
C — No. 245P . . . . . 200 WSP 550F, 400 WOG
D — No. 237P . . . . . 150 WSP 500F, 300 WOG
E — "500 Brinell" Stainless Steel Plug Type Seat and Disc

Walworth offers four lines of Bronze Globe Valves with stainless steel, plug-type seats and discs. Advantages of these valves include:

• **Stainless Steel Plug-Type Seats and Discs,** heat-treated to a minimum of 500 Brinell hardness reduces wire-drawing to a minimum. Seats and Discs are machined and fitted simultaneously, assuring perfect mating.

• **Deep Stuffing Boxes with Glands** are fitted with reinforced, molded packing. Valves can be repacked under pressure when fully opened.

For Longer Bronze Valve Life . . .

"500 BRINELL" PLUG-TYPE STAINLESS STEEL SEATS AND DISCS

150 lb. 200 lb. 300 lb. 350 lb.

• **Oversize Stems,** made of high tensile strength silicon-bronze, assure long life.

• **Rugged Body Hexes,** are flat on top; do not interfere with wrench gripping body-to-bonnet union ring connection.

• **Bodies,** made of Composition M bronze (ASTM B61), have ample wall thickness to provide high safety factor.

• **Patented Handwheels** are air-cooled and designed with a "finger-fit grip." Makes turning easy even when wearing greasy gloves.

• **Identification Plates** secured by lock-washer under stem nut, show Figure Number of valves and make re-ordering sure and easy.

FOR COMPLETE INFORMATION, SEE YOUR WALWORTH DISTRIBUTOR OR WRITE FOR ILLUSTRATED CIRCULAR

WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALOYCO ALLOY STEEL PRODUCTS CO. CONOFLOW CORPORATION M&H M & H VALVE & FITTINGS CO. SW SOUTHWEST FABRICATING & WELDING CO., INC. WALWORTH COMPANY OF CANADA, LTD.

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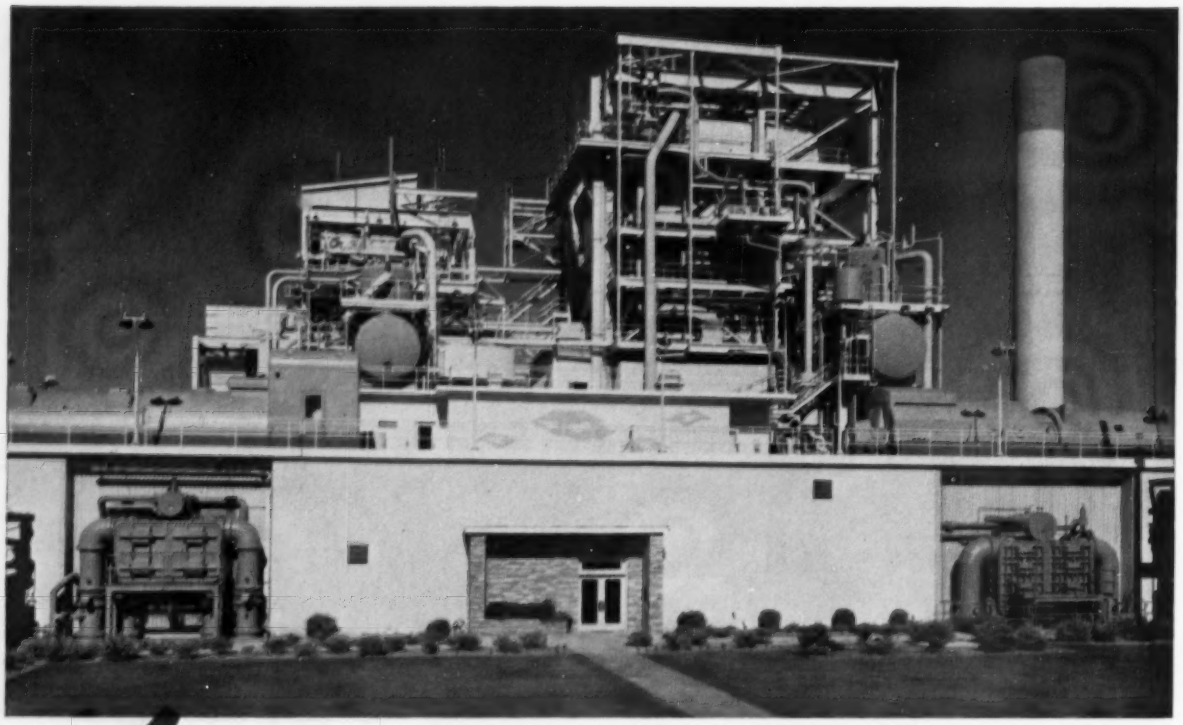


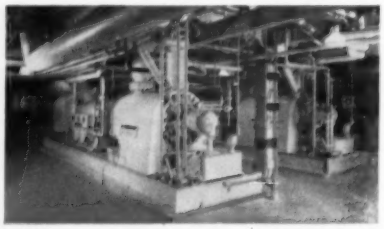
Again KYRENE STEAM PLANT

saves under-turbine space with I-R rectangular condensers

When Unit No. 1 of Salt River Power District's Kyrene Steam Plant went on line in June 1952, its 30/33,000 kw turbine-generator was served by a space-saving 27,500 sq. ft. I-R rectangular condenser, with I-R circulating and condensate pumps.

Now the same economy of under-turbine space has been extended to the newly completed Unit No. 2. Here, at right in photo above, the 60/66,000 kw turbine-generator is served by a 47,500 sq. ft. I-R rectangular condenser—again with I-R circulating and condensate pumps.

Designed and built by the Bechtel Corporation, the Kyrene plant located near Phoenix, Arizona represents the last word in modern, outdoor-type design. To assure maximum continuity of service, all major equipment was selected on the basis of long-range *dependability* in continuous, heavy-duty service. That's one of the vital but unseen features that's built into every item of Ingersoll-Rand steam plant equipment. Ask your I-R representative for complete details on the equipment best suited to your needs.



I-R BOILER-FEED PUMPS serve new generating unit, too

The 642,000 lb. per hr., 1500 psi steam generator for Unit No. 2 is served by the two Ingersoll-Rand high pressure, double-case boiler-feed pumps shown above—each rated 1,560 gpm, 4100 ft. head. Pump speed is flexibly controlled by an automatic fluid drive coupling.

Ingersoll-Rand

4-356 11 Broadway, New York 4, N. Y.

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • AIR & ELECTRIC TOOLS • ROCK DRILLS

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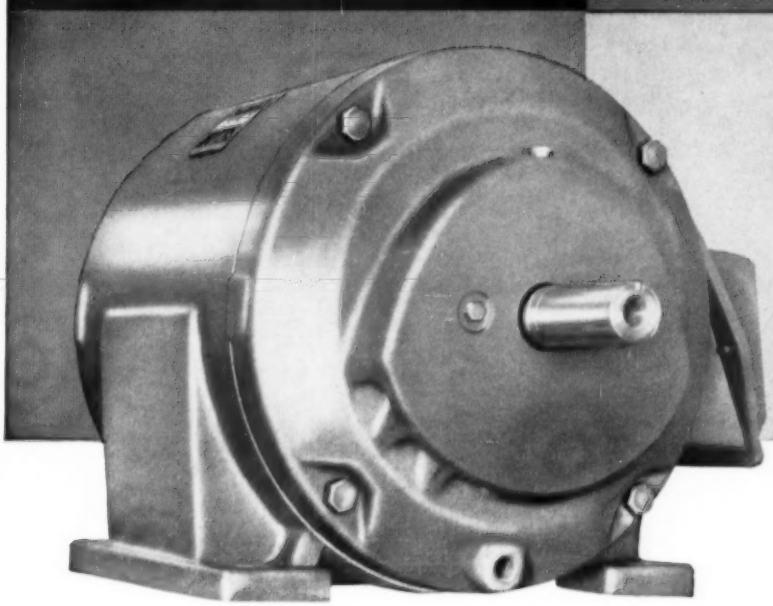
Totally Protected



FROM CORE TO COVER

RELIANCE *Totally-Protected* MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

Slot cell insulation of Double Backed Mylar

Dynamically balanced rotor for vibrationless operation

Entire insulation system impervious to acids, moisture and oils

Metering plate regulates grease flow to bearing

Ventilation louvers positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details?

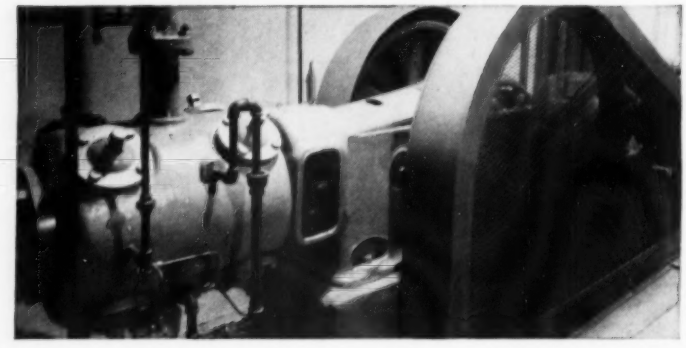
RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 76A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

Sales Offices and Distributors in Principal Cities

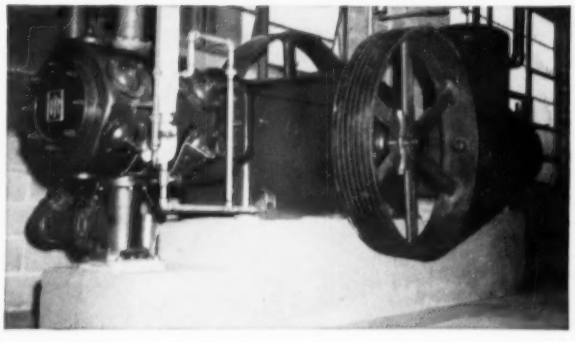
Circle 42[illegible] on reply card

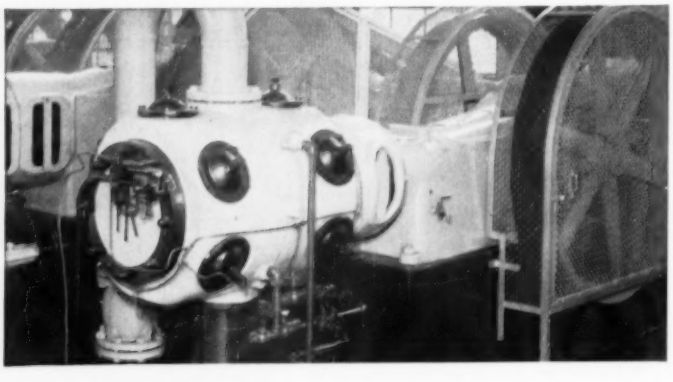
Industry after industry gets less wear, steady air with compressor crankshafts on TIMKEN® bearings



AIR SUPPLY IN OIL RESEARCH LAB IS STEADY with Timken® tapered roller bearings on the crankshaft of this Ingersoll-Rand ES-1 compressor. With Timken bearings, shafts are kept concentric with housings. Closures are more effective. Lubricant stays in—dirt and moisture stay out. It's an example of how Timken bearings cut maintenance costs, keep compressors operating smoothly.

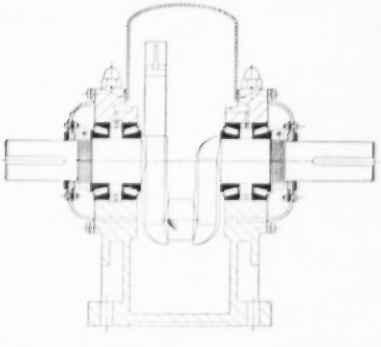
COMPRESSOR SPEEDS CHEMICAL DRYING with Timken tapered roller bearings to keep it on the go. This Ingersoll-Rand ES-1 compressor blows air through a filtered chemical product to remove moisture. Timken bearings on the crankshaft help it do a dependable job with a minimum of wear. Because of their tapered construction, Timken bearings take both radial and thrust loads in any combination. And full line contact between Timken bearing rollers and races gives them extra load-carrying capacity. With the crankshaft held in positive alignment, wear is held to a minimum, downtime and repair costs are cut.





BREWERY KEEPS PRODUCTION UP TO PAR because Timken bearings help reduce compressor power loss. With the crankshaft of this Ingersoll-Rand class ES compressor mounted on Timken bearings, friction is practically eliminated. That's because Timken bearings are designed by geometrical law to have true rolling motion, and they're manufactured with great accuracy to live up to their design.

HERE'S A TYPICAL INGERSOLL-RAND MOUNTING of compressor crankshafts on Timken tapered roller bearings to assure long bearing life with minimum maintenance.



TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

TRADE-MARK REG. U. S. PAT. OFF.

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